Annual Report 1984

Salmonid Enhancement Program

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Province of British Columbia Ministry of Environment

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Director's Report

It has now been eight years since SEP was launched. As with any venture, time has brought changes. In its early years, the program was characterized by planning and development activities. Innovation and creative problem-solving provided a focus for a program that had undertaken a monumental challenge; to restore the salmonid populations of the region to their historic abundance. In many ways, SEP resembled a newly-launched high-technology company; the big question was, how? How to set up the structure? How to solve the technical problems? How to measure results?

As with a developing corporation, however, a time has come for a new emphasis, an emphasis on results. Today's questions are results questions. How well are we performing? Have we reached production targets? What is our contribution to the fisheries? Is the operation cost-effective?

In response to this shift in focus, you will see some changes have occurred in the annual report over the past few years. At one time SEP had only juvenile releases to report; returns were still nonexistent. Today, there are returns to almost all SEP-funded projects. In some cases it is now possible to determine what SEP has actually contributed to the fisheries, rather than just what it expects to contribute some years into the future.

It may seem strange that some stocks continue to be threatened, and that overall catch figures are not dramatically improved over those of pre-SEP years. It must be remembered, however, that SEP is only one component in an active and interactive environment that fisheries managers must cope with.

Fish populations are also affected by a multitude of other factors; habitat in fresh water, over which we exert some influence, and in the ocean, over which we exert virtually none, and the deep-sea fishing efforts of many nations, the impacts of which are still largely unknown. As well, fleet technology is changing and sport fishing is growing rapidly in some areas. These factors may result in declining total numbers of some species, even where SEP efforts have produced a much increased supply in the juvenile levels. In such situations, it is appropriate to consider just where those particular stocks would be today had SEP not been launched in 1977.

The fishery resource is one of the most complex management problems facing Canada today. Most natural resources are static; they just remain in, or on the ground until someone removes them. They also remain largely unchanged for the time that they are left. Lumber, petroleum deposits and ore bodies can also be counted on to stay within the borders of the nation that owns them. Not so with fisheries. This resource is migratory, spending a portion of its life cycle in an environment about which we still know all too little. It is also biologically active; birth, migration, growth, maturity and death will occur with or without human involvement. These characteristics provide the opportunity for enhancement, but they also complicate the challenge.

Continued research is necessary to learn more about ways to improve survivals and to produce not only greater numbers, but also larger, better-quality fish. Enhancement must also operate in concert with management strategies to optimize the benefits from the program. The new Pacific Salmon Resource Management Plan recognizes this need.

International agreements, such as the recently-signed treaty with the U.S., may play an increasingly significant role in assuring that Canada benefits from its own enhancement efforts. Certainly, the treaty makes enhancement on the Fraser system an important opportunity for the future.

SEP has developed a wide variety of activities and techniques to increase fish production. We must now concentrate on making these produce maximum benefits. To this end, activities of SEP in 1984 have begun to reflect a broader set of concerns and a more complete integration of SEP with other DFO programs.

One highly-visible example of this was provided by the Public Awareness Campaign which was launched in 1984. SEP spearheaded this effort at increasing public understanding of the resource and of how citizens and DFO, acting together, can benefit the resource. The campaign was a cooperative effort between many components of the department. Fishery officers, ship crews and hatchery personnel were all contributors. In the process of working with local communities, DFO employees became better acquainted with each other, as well as with their communities.

The past year has been highlighted by significant achievements. Public Involvement projects are maturing with existing projects taking on a greater assessment component. This increased emphasis on the biological foundation for enhancement projects greatly increases their level of professionalism.

Public Involvement efforts are showing an impact on the results level, too. At Noons Creek, in 1984, approximately 400 coho (1981 brood) returned to spawn. Tagging data reveal that the project also contributed 563 fish to the commercial and sport fisheries; an impressive contribution from a volunteer working in his backyard.

Terminal fisheries at the SEP facilities are also showing results. In the Queen Charlottes, over 177,000 chum were caught at Cumshewa and Skidegate Inlets. Terminal fisheries were also very successful at Bella Coola, Conuma and Nitinat.

A greatly expanded marking program was also undertaken in 1984, with over 12 million coho presmolts being finclipped. The resulting data will provide valuable input for both enhancement and management decisions in the future.

Maturity has been the key feature of 1984. Maturity of the total enhancement plan; natural, semi-natural and artificial enhancement techniques being used together. Maturity of major production facilities which shows expanded rearing capacities and increased expertise. Maturity of Community Economic Development Projects is revealed as their production figures rise. Maturity of the Public Involvement Program is seen in increased expertise and in the increasingly ambitious projects which volunteers have undertaken. Maturity is demonstrated in the increasing cooperation of all levels of government and in the continuing support provided by public advisory bodies.

Maturity is also revealed in the Pacific Salmon Resource Management Plan, which recognizes SEP as an important element in the production and management of the resource. More effective enhancement, properly integrated with fisheries management will ensure increased benefits from the Pacific salmon resource for years to come.

Harold Swan
Acting Director, SEP

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1. The Devereux Creek pilot project has been set up to investigate chinook enhancement prospects for Knight Inlet.
2. Judd Slough, in the Squamish River system, before the modifications which were undertaken.
3. Judd Slough after extensive work was done in 1984. It is expected that the improvements should quintuple production of chum and coho.

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South Coast (Mainland)

Capilano Hatchery

Capilano hatchery is situated in scenic Capilano Canyon Park in North Vancouver, immediately below the Cleveland Dam. It is approximately five km upstream from the mouth of the Capilano River.

Hatchery Capacity and Facilities

The hatchery, when constructed in 1971, was designed to produce one million juvenile coho, 350,000 chinook and up to 65,000 steelhead trout yearly. Subsequent modifications have increased the capacity by an additional 2.5 million juvenile chinook annually. Adult fish handling facilities at the hatchery include a river barrier, fishways, a trapping and brailing system, two Burrows' type adult holding/juvenile rearing ponds, and two circular fiberglass tubs. Juvenile facilities include ten standard Burrows' ponds and thirty rearing troughs. Incubation facilities include Heath tray stacks and freestyle boxes. To provide capacity for Expo 86 fry and permanent rearing for an additional 1.4 million chinook salmon, underground gravel filters were converted into raceways. The gravel was removed and each filter was divided into four raceways by concrete walls. The raceways are 11 m long and 1.2 m wide. To facilitate the movement of fish food and fish to or from the lower raceways, an elevator was designed and construction started.

A pipeline from Capilano Lake supplies the hatchery with surface water. In addition, groundwater is provided from a network of underground tunnels in the vicinity of the east end of the Cleveland Dam. This groundwater can be heated to a temperature in excess of 20°C to manipulate egg development during incubation and to provide almost ideal conditions for the initial rearing of newly hatched fry. Because Capilano River water is generally very cold, this heated water is a most valuable asset.

The hatchery complex also includes offices, laboratories, workshop and research facilities, standby generator and public display area.

Operations

Juvenile fish releases from Capilano hatchery in 1984 numbered more than 2.75 million, made up of 1.61 million chinook, 500,000 coho to the upper Capilano watershed, 503,000 coho to the lower river and 160,000 steelhead fry and smolts. Once again, approximately two-thirds of the chinook produced were from eggs from Big Qualicum River hatchery, to supplement collections at the hatchery.

Chinook sizes at release ranged from 4 to 8 g while coho remained in the 15 to 20 g size. In addition to the 12,800 two-year-old steelhead released from the hatchery, surplus yearlings and fry were also released in the upper Capilano River. The coho production represents an average year for the hatchery.

Research activities carried out on a production scale during the year included:

- run time/spawn time study on coho
- a test on the delayed effects of egg disinfection
- a comparison of inside versus outside rearing
- the production of an all female group of chinook
- size grading of juvenile coho.

Experiments which did not involve CWT releases included:

- the effects of fluctuating rearing temperatures
- further grading studies
- inside versus outside rearing
- sterilization/feminization manipulation studies.

A repeat of the eurythromycin/teramycin injection control of BKD in adult coho was carried out, as well as further studies relating to rearing densities and pond loadings. Some experimentation was also carried out on the plastic bag method of juvenile fish transport. Rearing strategies continue to be somewhat experimental in many respects for all species and brood years.

While adult escapements to the hatchery were down from previous years, a considerable increase in exploitation rate was evident for all species in the river and in Burrard Inlet near the mouth of the river. Only 17,000 coho and 1,800 chinook were trapped at the hatchery, and the number of summer-run steelhead was less than twenty, although a good fishery was reported in the river.

A record 2.6 million chinook eggs were collected from the adult escapement to the hatchery. The flow conditions and freshet timings combined to provide excellent quality fish at peak spawning time and condition, resulting in high quality eggs. More than 1.5 million coho eggs were collected in addition to the normal hatchery requirements to supply fish farmers, community projects and researchers. More than 340,000 surplus coho juveniles were distributed to fish farmers on the Sunshine Coast.

All hatchery operations were carried out without serious incident or loss of fish during the period under review.

Tourist Attraction

Capilano hatchery continues to be a favorite attraction for local visitors as well as for tourists from all over the world; over 300,000 people passed through in 1984. To provide the tourists with more and better information, signs in English, French and Japanese were installed. A kiosk for tour guides was designed and built. The viewing area was covered with a new roof membrane, new walkway grating was placed over the fishway, benches and garbage receptacles were provided and a fence erected to block public access to the inner workings of the hatchery.

Severe flooding in November 1983, deposited large amounts of blasted rock in the river bed adjacent to the hatchery. The rock, originating from the Cleveland dam construction, created a weir and raised water levels at the hatchery. The rock was moved up the west bank by Link Belt excavator.

Contact: Eldon Stone, Stock Enhancement Officer; Wai Leung, Project Engineering.

Seymour River Hatchery (BCIT)

The Seymour River hatchery is run by BCIT on contract to SEP. Its location in North Vancouver just below the Rice Dam is convenient for involvement of students from the BCIT resources program. The facility provides the student with working, hands-on experience in the areas of enhancement and fish culture practices.

SEP's objectives are met through continued enhancement of summer and winter run steelhead, cutthroat and coho stocks.

The program employs one full-time manager and two assistants; additional labor is available through a work study program and volunteer student projects.

A donation was received from Sport Fish America which allowed the hatchery to upgrade its incubation and rearing facilities in 1984.

Plans for 1985 include ongoing enhancement, investigation of habitat improvement on small feeder streams and continued upgrading of site facilities.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Deep Cove Sea Pens (BCIT)

The Deep Cove sea pen operation is run by the B.C. Institute of Technology resouce program. 130,000 1983 brood coho from Capilano hatchery are currently being reared for release in 1985 for the 1986 Expo fishery.

This site will also provide a rearing facility for the 1986 children's fishery at False Creek, as well as a research and experimental location for the fish culture and nutrition section from the West Van laboratory.

The project provides employment for one full-time person and allows BCIT students the opportunity to gain valuable fish culture experience.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Tenderfoot Creek Hatchery

The Tenderfoot Creek facility has been in full operation since summer 1982. It is located north of Squamish on Tenderfoot Creek. Proposed 1984/85 targets for the hatchery were:

- chinook: 500,000 eggs
- coho: 400,000 eggs
- steelhead: 140,000 eggs.

Operations

Steelhead were obtained by angling from the Cheakamus and Squamish Rivers. The fry were reared to approximately 0.7g, then transported by helicopter to various locations in their rivers of origin.

The 1984 chinook brood stock was gillnetted or angled from various local rivers; Cheakamus, Squamish and its tributaries and the Ashlu. Trucks with tanks were used to transport the adults back to the hatchery, where they were held until ripe and then spawned. Approximately 250,000 eggs were taken. The resulting fry will be reared to smolt stage and a portion of the released smolt will be tagged (CWT) to evaluate production and time of release.

The adult coho escapement to Tenderfoot in 1984/85 was above normal, with over 1,000 fish returning. Approximately 325,000 eggs were taken this year, slightly below the target of 400,000.

The shortfall on the Upper Squamish stock was due to limited access as a result of major flood damage to access roads and a heavy snowfall. Coho brood stock was captured by a semipermanent trap on Tenderfoot Creek and gillnetting on other rivers.

Approximately 50,000, 1982 brood coho smolts were released in Shovelnose Creek, an Upper Squamish tributary. These smolts were part of an experiment to evaluate fry plants versus smolt plants. Another 43,000 coho smolts were released from Tenderfoot Creek hatchery.

Construction/Maintenance:

Four additional holding containers were installed to increase capacity and flexibility of adult holding/juvenile rearing. Construction of a workshop/warehouse was completed. A further 0.66 ha of land was purchased for proposed future expansion.

The facility had the physical capability to expand and cater to an increase in fish production but was limited from expanding because the maximum supply capacity of the originally constructed water system was not great enough.

The Engineering Division brought a third well into production which produces approximately 8,000 L/M, doubling the available water supply. This well was previously drilled and developed in 1981 and capped for future use.

The project was completed on a construction management basis with much of the physical work done by SEP engineering staff. A new pump was bought and installed in well #3, a concrete block pumphouse was erected over the well and a new larger capacity reinforced concrete aeration tower and storage tank were constructed. A new underground pipe supply system was installed and interconnected with the existing distribution system. The new well is now the principal source of process water, with wells #1 and #2 serving as back-up and supplementary supply.

Expansion Plans

Further reconnaissance and survey work will be carried out in 1985. A survey was carried out and a study report written on a search for a source of surface water, for supply to both the present hatchery and proposed expansion. It is desired to have slightly warmer water for incubation and rearing to help increase fish release weights. No suitable source was found and exploratory deep well drilling is to be carried out in 1985 to search for the alternative of geothermally heated water.

Contact: Bill Foye, Stock
Enhancement Officer,
Enhancement Operations;
Ian Ross, Project
Engineer, Engineering.

Sechelt Community Development Project

This project is located near the head of Sechelt Inlet at Porpoise Bay and is operated by the Sechelt Indian Band under contract to SEP.

The objectives of the project include the improvement of coho and chinook sport fishing opportunities in Sechelt Inlet as well as the enhancement of local chum salmon stocks in Angus Creek.

The new hatchery at this project began operation in 1984. At the end of 1984, there were approximately 39,000 '83 brood coho being reared in the sea pens for release in June '85.

The hatchery is presently incubating 68,000 chinook and 86,000 coho eggs collected entirely from adult fish of previous years' releases. In addition, approximately 58,000 chum salmon eggs were collected from nearby Angus Creek and incubated at the Sechelt hatchery. Tagging information indicates that survival to adult is approximately 12 percent and that approximately 50 percent of the catch went to the sport fishery and the balance to the commercial fishery.

A number of significant improvements were made to the facility this year to accommodate increased fish production. In anticipation of the rearing of Expo coho, new sea pens were assembled to bring the capacity to 1,000 m^3. The fresh water sources occasionally become supersaturated, so an aeration tower was constructed. To meet an increased demand for fresh water at the new sea pens and because available fresh water is so limited, it was necessary to build a settling basin and aeration tower that will reuse wastewater from the freshwater rearing containers. An alarm system was installed to advise the crew of problems with security, fire and water delivery. Two new rearing troughs were added this year, giving a rearing capacity of approximately 120,000 fish to 5 g size.

The Sechelt Indian Band was able to secure a job creation contract to employ 4 to 6 people from April to August to do a variety of jobs in the community and make numerous site improvements at the hatchery. Among these were: totem and flag pole erection, storage shed construction, landscaping, road improvements and stairwell construction.

Each of the crew received instruction in computer applications for fish culturists. Onsite training this year has focused primarily on data management, evaluation and report preparation.

Facility operations for 1985 will incorporate procedures and strategies such as differential size release and timing for salt water introduction, multiple tag groups, etc. in order to be able to assess the best operating strategies for the future.

Improvements to the facility will include installation of a pump to deliver salt water to the hatchery. This will not only provide more water, but it will also enable the staff to manipulate the acclimatization and to accelerate the maturation of adults and presmolts. Improvements will be made to an aeration column for incubation and the old sea pen float will be repaired and refurbished.

The crew will continue to monitor some of the physical characteristics of nearby creeks and receive upgrading of their fish culture and managerial skills.

Contact: Maurice Boisvert, Project
Coordinator, Community
Economic Development Unit,
Special Projects Division.

Powell River Salmon Society

The main focus of this project is the operation of a coho hatchery and rearing facility near the headwaters of Lang Creek approximately 15 km east of Powell River. The facility is operated by the society under contract to SEP.

The main objectives are to enhance natural runs of coho (and possibly chinook and steelhead in the future) to historic levels, to improve sport fishing in the area and to develop and promote public awareness for the program and the salmon resources.

A new permanent aerial suspension fence for brood stock collection was constructed on Lang Creek approximately 2.5 km above tidewater. Staff also assisted in brood stock collection and egg-takes for PIP projects at Myrtle and Whittal Creeks.

Of 1,525 coho adults enumerated through the fence, 295 were used for brood stock. Peterson disc tags were applied to 175 migrants to assess distribution, but evaluation was inconclusive due to problems with access. Staff operated the fence throughout the winter months to enumerate steelhead and assess migration timing for the provincial Fish and Wildlife Branch.

Other activities included downstream trapping and monitoring. Flow and temperature profiles of Lang and other nearby creeks were prepared at regular intervals all year. These creeks were observed twice during the year to identify habitat problems and potential enhancement opportunities.

Phase I development to attain a production capacity of 250,000 coho eggs was completed this year. The building was finished, an alarm installed, a hydroelectric power generator was constructed and connected, the access road was upgraded, the river intake was modified to protect the pipeline and a partially collapsed pipeline was repaired. Three additional fiberglass rearing troughs were constructed by the staff and two aluminum troughs were installed. A cement slab was poured under the rearing containers and security fencing was attached around the perimeter. The staff designed their own modified upwelling gravel incubator and portable egg-eying chambers as well as a demonstration incubator. Additional vertical tray incubators were repaired and installed.

Access to a flow regulation device at the outlet of Haslam Lake was successfully negotiated with the municipality. This will help enormously to provide optimum flows for salmonids in the Lang Creek system. Significant contributions for some of this work came from the staff, society members, MacMillan Bloedel and other local businesses. The Ministry of Forests and the municipal governments have been extremely helpful and cooperative.

Apart from periodic onsite training, some of the crew were exposed to formal courses on computer applications for fish culturists and project management.

Others visited hatchery facilities throughout Vancouver Island.

In 1985, a major effort will be made to assess the success of 1984 coho outplants to Haslam Lake. The biological program will concentrate on developing the optimum rearing, release and growth strategies for this facility and for the carrying capacity of Haslam Lake. Improvements will be made to the hydroelectric plant, the raceway, the hatchery surroundings and the access gate.

Monitoring, tagging, reconnaissance, stream improvement, brood stock collection and adult enumeration will continue to be an integral part of the 1985 hatchery program.

Contact: Maurice Boisvert, Project
Coordinator, Community
Economic Development Unit,
Special Projects Division.

Sliammon Hatchery

This hatchery and rearing facility, located approximately eight kilometers north of Powell River on the Sunshine Coast, is operated by the Sliammon Indian Band under contract to SEP. Enhancement activities are directed primarily toward chum and coho salmon on the Sliammon River. Production capacity is approximately 1.1 million chum and up to 200,000 coho eggs. The latter, however, has never been attained due to poor escapement. In addition to direct fish culturing activities, the band operates a flow control weir at the outlet of Sliammon Lake and has been involved with the development of a saltwater rearing facility at Okeover Inlet approximately eight kilometres north of Sliammon River.

In 1984, the staff released 968,357 chum fry at 1.5 g average weight to the Sliammon River. Approximately 10 percent of these (1,000,539) were marked with a right ventral clip to help assess survivals. A total of 34,340 1983 brood coho were ponded in April. Of these, only 15,000 and 10,000 - 10 g tagged fingerlings were released to the Sliammon River and Lake respectively. The balance were still being reared at the end of the year, but were due for release to Sliammon Lake as 20 g smolts in May 1985. In addition, 7,307 pink fry were released to the Sliammon River upon emergence in February 1984.

Nearly 20,000 chum salmon were enumerated through the brood stock collection fence. An additional 4,000 fish were estimated in the Sliammon River. Of these, 427 females and 218 males were used to collect 1,110,760 eggs. Nearly 70,000 coho eggs were collected from October through December. Several pipeline flushouts were installed this year to permit the release of supersaturated water from the lake supply pipeline. The flow control weir at Sliammon Lake outlet was completed early in 1984. In anticipation of Expo coho, new sea pens were constructed at Okeover Inlet which will accommodate nearly 1,225 kg of fish. Very low flows in the summer of '84 have caused reevaluation and postponement of the development of a freshwater supply at Freak Creek at Okeover Inlet. It is expected, however, that a new water supply will be constructed in Okeover Inlet this coming year.

Okeover Inlet and Creek were monitored throughout 1984 to help develop operating strategies for the saltwater rearing and brood stock collection activities. A management decision against release of Expo 86 coho at this site and a shortage of available brood stock in Okeover Inlet will likely postpone the operation of the sea pen development.

Hatchery staff received formal training in project management and in computer applications for fish culture technology. Onsite training has focused on data collection, management, evaluation and report preparation. Additional onsite training included an introduction to computers, estimating population size using the Peterson index and continuous upgrading of fish husbandry skills.

The Sliammon Indian Band was able to secure a job creation contract this year to:

- remove logs at Sliammon Lake outlet
- construct a shed for Okeover sea pens
- modify the coho rearing pool setup
- prepare and install an informational sign
- construct and modify existing freshwater delivery systems for the Okeover sea pens
- assist with obtaining accurate escapement counts to the Sliammon River and other sites and
- train with Discovery Park's personnel in aquaculture-related activities.

Plans for next year include; continue the operation and maintenance of the facility and flow control weir, monitor Sliammon and Okeover Inlet water supplies, conduct downstream enumerations, collect brood stock, enumerate adults, construct a freshwater intake at Okeover, mark chum, landscape and repair the road and modify the alarm system to enable detection of the supersaturation of the water supply.

Contact: Maurice Boisvert, Project
Coordinator, Community
Economic Development Unit,
Special Projects Division.

Vancouver Bay Project

The Vancouver Bay hatchery, a joint project of DFO and B.C. Forest Products, is situated on Jitco Creek, a tributary of the Vancouver River. The hatchery was designed to enhance depleted chum and pink salmon stocks in the area. Small numbers of coho, steelhead and chinook are also being enhanced.

In June, 40,000 chum fry were released at 1 g into Jitco Creek, and 71,376 coho fry and 7,600 steelhead fry were released in September by helicopter into the Vancouver River system.

Twenty thousand Capilano chinook fry, incubated and reared at Vancouver Bay, were released late June into Jitco Creek at 1.5 grams. Similar numbers of 1984 brood steelhead, chinook and coho are expected to be reared for 1985 release. Production goals for 1985 brood chum and pink are 1 and 2 million eggs, respectively. Actual egg-take for this run of odd-year pinks will depend upon the number of adults which return to Vancouver Bay. The transplant program of earlier years has been discontinued due to its high cost.

In even years the chum goal is set at 2 million eggs, there being no pink run.

Contact: Mel Sheng, Biologist,
Special Projects
Division.

Mainland Inlet Reconnaissance

A considerable amount of reconnaissance work was performed in the mainland inlet areas, notably Bute Inlet, Knight Inlet and Thompson Sound, in 1984.

The Kakweiken, Ahnuhati, Glendale, Phillips, Orford and Southgate river systems were focused on as areas of particular interest. Each river has interesting features and all are potential candidates for salmonid enhancement work. Reconnaissance in these areas is required to gather necessary data related to hydrology, topography and fish movement with a view to compiling a data base for planning future facilities and improvements.

Work including aerial photography, surveying and stream metering will continue on through 1985 to ensure continuity of data collection and to increase familiarity with the areas.

Contact: Jim Wild; Roy McGechaen,
Engineering.

Devereux Creek Pilot Project

This pilot project is located on Devereux Creek, a tributary of the Klinaklini River, which flows into the top end of Knight Inlet. The purpose of the facility is to investigate the potential of the Devereux system for chinook enhancement to mitigate the effect of incidental catches in the pink fishery in Knight Inlet. It is also intended to test the feasibility of operating in remote mainland inlets.

Two main tasks were set for this facility: the first, to gauge the susceptibility of chinook salmon to IHN disease transferred from kokanee resident in the system; the second, to provide a production lot of fry to be tagged and released to aid in management studies. Approximately 300,000 eggs will be incubated.

Work began in late 1983 on the design of the facility. Conventional incubation tray, intermediate rearing trough and rearing channel technology was chosen. Buildings consist of portable structures ensuring rapid and inexpensive redeployment elsewhere at the end of the pilot. A submerged lake intake and pipeline supply water to the facility and a portable powerhouse and fuel system provide electrical power.

Experimental work takes place in a laboratory trailer which is equipped not only with normal testing equipment but also contains chlorination/dechlorination apparatus to treat infected effluent.

Access to the site is by logging road leading from barge and float plane docking areas at tidewater.

Construction of the project was awarded to a Nanaimo contractor for $438,000 and was completed and ready for operation on September 1, 1984.

The operation of the facility was contracted out to a private firm. It was unable to gather sufficient brood stock to provide the necessary number of eggs. The decision was then taken to terminate operations until fall 1985.

Contact: Roy McGechaen, Engineering;
Brian Pearce, Acting Head,
South Coast Unit, Enhancement
Operations.

Indian River Feasibility

Indian River is located at the head of Indian Arm, approximately 20 km north of Port Moody. Because Indian Arm is protected from weather, is close to the population centers of the Lower Mainland, and is away from shipping lanes, it is often proposed for enhancement, and several feasibility studies have been done over the years. In view of the investment by DFO and SEP in this area to date, it was felt necessary that the rather scattered results be consolidated into a formal report.

In conjunction with SEP Enhancement Operations staff, a consultant completed three reports in 1984. These compile and review the data pertaining to the groundwater surveys undertaken from 1972 to 1981, the 1979/80 chinook pilot hatchery and the 1971-81 coho sea-pen rearing operations. The conclusion was that it is unlikely that a major multispecies hatchery would be successful on the Indian River, mainly because of water quality problems. A facility that concentrated on species such as pink and chum, that require little or no freshwater rearing, may be more viable.

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations.

Knight Inlet Reconnaissance

Knight Inlet is approximately 75 km north of Campbell River and has been proposed for major enhancement efforts. Biophysical and spawner reconnaissance studies of several Knight Inlet streams have been carried out since 1981. Two study reports were completed in 1984. One report by New Projects staff examined the possibility and potential impact of premature emergence of pink fry with the use of the warmer Tom Browne Lake water to supply a spawning channel on the Glendale River; it was concluded that pink fry migration would be advanced, but not to the extent that survival would be reduced due to lack of available feed in the early spring. A second report, on 1983 spawner and biophysical surveys, estimated spawning and rearing capacities for each species and system, including the upper Klinaklini system. Contracted juvenile migration and rearing studies of the Klinaklini/Devereux, Tom Browne/Glendale, and Ahnuhati systems were undertaken in the spring and summer of 1984.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

South Coast Unit Biology

A number of programs were carried out in 1984 to increase the effectiveness of SEP production facilities. These programs were developed by facility staff and support biologists in response to immediate fish culture problems. Often, scientific and technical input from the Pacific Biological Station, the provincial government or from private consulting companies played a key role.

Carbon Dioxide as an Anesthetic

Handling adult salmon for brood stock collection requires the use of an anesthetic. If surplus fish return to a facility and are eventually to be sold for human consumption, then a non-chemical anesthetic must be used. High concentrations of carbon dioxide offer promise as an inexpensive, safe and effective alternative to the usual chemical anesthetics. However, its effectiveness seems to depend on a number of variables such as pH, water temperature, fish size and oxygen level. Work at Big Qualicum and Robertson Creek hatcheries this year resulted in a much better understanding of how this anesthetic functions under production conditions. A manual for the use of carbon dioxide anesthetic should be available in 1985.

Quinsam Watershed Study

Coho fingerlings have been transported to the upper Quinsam watershed yearly since 1978. This area is also the site of a proposed open pit coal mine. Last year, extensive baseline data were collected for this area. Such information will not only help to improve the coho colonization technique, but is also necessary if the impacts of the mine are to be minimized. Reports summarizing this data are available in draft form.

Benefits and Costs of Aerating a Water Supply

Chinook salmon rear in fresh water over the spring before being released to the ocean in June. In the Puntledge system, solar heating combined with the effects of hydro development results in the river water becoming supersaturated with atmospheric gas. Elevated levels of supersaturation stress the young fish, which can result in severe problems during early rearing. This was the second year of a three-year study designed to assess whether installation of packed column aerators (which reduce supersaturation) would result in significant benefits to the chinook rearing program at the Puntledge hatchery.

Steelhead Incubation Problems

Over the past 10 years, many problems have occurred with the incubation of steelhead in Heath trays at Robertson Creek hatchery. Mortality usually begins shortly after hatch. Seemingly healthy alevins suddenly become lethargic and die -- this syndrome has been termed crib death. In 1984, an experiment was designed (with input from Fish and Wildlife Branch and Pacific Biological Station scientists) to determine the cause of this bizarre problem. It seems that many of the past problems were due to entrainment of air under the bottom screen of the Heath trays. This air can coalesce into large bubbles which effectively block water flow to large areas of the tray. Alevins or eggs above such a blockage die rapidly due to lack of oxygen. Why bubbles form so readily at this particular hatchery and how to control their formation is not well understood at this time. Bubble formation may be related to the fact that water temperatures are increasing rapidly during steelhead incubation (April, May). Sloping the trays has been attempted as a way to shed bubbles as they form. This approach can lead to severe short-circuiting of the water flowing through the tray and can also result in suffocation. At present, Heath trays have been abandoned as a method for incubating steelhead alevins at Robertson Creek hatchery.

Development of a Safe Electric Barrier

Collecting brood stock or enumerating adult salmon is extremely difficult and expensive in coastal rivers. These streams are characterized over the autumn period by heavy flooding. Furthermore, these high flows usually contain substantial quantities of logging debris. This makes conventional mechanical fences almost impossible to operate over this critical period. If a salmon run is being diverted for either enumeration or brood stock collection, loss of control of the diversion barrier for even a short period of time can mean the failure of a program. As well, attempts to maintain mechanical fence operations during flood periods are dangerous for the fish culture crew. Many years of experience in the U.S. and in B.C. has shown that electric fences operate effectively even under these severe conditions (high water and debris). It is also recognized that conventional electric fences pose a safety hazard. In 1984, a program was designed that should lead to a pilot scale electric fence being built in 1985 that is both safe and effective.

Tsolum River Investigations

Poor returns to the Tsolum hatchery over the past several years led to an investigation into the fish culture techniques being used and also into possible water quality problems associated with the Tsolum River. This study was carried out in cooperation with the habitat protection branch and the provincial Ministry of the Environment. It is now recognized that copper leaching from an abandoned mine site on Mt. Washington may be causing some problems far downstream in the Tsolum River. Copper levels are being monitored in the watershed and the Ministry of the Environment is conducting copper bioassays at the nearby Puntledge hatchery. This program will extend into 1985.

Contact: W. E. (Bill) McLean,
Operations Support Biologist;
Brian W. Andersen, Operations
Support Biologist,
Enhancement Operations.

Side Channel Projects

Five groundwater side channels have been created in the south coast area since 1978. One (Westholme Channel) is located on Vancouver Island; the other four (Upper and Lower Paradise, Mamquam and Judd Slough) are located within the Squamish River system.

Westholme Channel, built in 1978, is now seeing returns of fish produced in the channel. Up to 20,000 chum salmon have spawned annually in this channel since 1982. This indeed is a dramatic return considering that few, if any salmon spawned in Westholme Channel prior to the 1978 improvement work. During 1984, the Halalt Band, under the direction of DFO, placed rip-rap armoring along the banks of the channel. A downstream fry fence will be in place to enumerate production from the 1984 brood spawning.

Judd Slough, which has had a long history of stream work by the Department, was upgraded in 1984. The upper 770 metres of the slough has been extensively reshaped by excavation, realignment of the channel, and by the placing of large rip-rap along the banks. It is hoped these actions will increase the present populations of chum and coho salmon from 5,000 to 25,000 and from 300 to 1,500 respectively.

Mamquam Channel, excavated in 1983

in cooperation with the provincial Water Management Branch, was regraded and had bank armoring placed in 1984. This work was aimed at producing an additional 20,000 chum and 1,500 coho adults annually. Since construction in 1983, use of this channel by chum and coho spawners has been high. A downstream trap will be operated in the spring of 1985 to enumerate all migrating fry and smolts.

A study has been underway at Upper Paradise Channel (Cheakamus River) looking at factors regulating coho production from an improved groundwater channel. Preliminary data suggest that high densities (>6.0 fry/m^2) of coho are resident in the channel up to the early fall period. After September, there seems to be an influx into the channel of coho juveniles which presumably had previously reared elsewhere in the Cheakamus System. Smolt production in spring 1984 was at a level of about 3 smolts/m^2, five times that previously recorded. A full assessment of coho production from this channel will be forthcoming at the completion of the 1985 smolt migration.

Further habitat improvement work in 1985 is proposed on the Cheakamus River (near Squamish), Grey Creek (Sunshine Coast), Chemainus River (Chemainus) and Oyster River (Courtenay).

Contact: Matthew Foy, Project Biologist, Small Projects Unit, Special Projects Division.

Phillips River Project

This project is located on a side channel of the Phillips River which flows into tidewater midway between Bute and Knight inlets. This area has had a long but checkered history. The buffering effect of Phillips Lake has helped to maintain suitable flows in the downstream spawning areas in spite of high precipitation, both rain and snow, in the heavily logged watershed. The remains of an Indian fishing camp of considerable archeological interest at the outlet of Phillips Lake testify to historically high fish production and even well into this century this area was known for its good commercial and sport catches. Since then, the depletion of Phillips River salmon stocks has been rapid. Pink salmon, however, still exist in sizeable numbers and it was with these fish that the rebuilding effort commenced.

The particular tool chosen for enhancement of salmon in this area was a spawning channel incorporating the concept of enlarging, improving and protecting an existing side channel. This would create a high-production natural spawning area and, at the same time, minimize visual and environmental disruption. The area immediately south of Phillips Lake lent itself well to this type of construction. It had all the fundamental requirements such as a plentiful supply of water, sufficient grade to ensure flow, a large fairly flat area for channel construction, a solid gravel base with the added bonus of groundwater flow and, very importantly, a nearby source of quality gravel for spawning beds. The configuration of the spawning channel was chosen with some care; first, to avoid interference with the archeological site near the lake outlet; second, to utilize the alignment of the existing side channel to the maximum extent; and third, to provide adequate space for future expansion. Dimensions of the channel were set at 25 m in width and 1,160 m in length to give a total usable spawning area of 29,000 square metres. The portions of the side channel not utilized are maintained as habitat for coho and trout by means of a culvert connecting the old channel with the new.

The first task consisted of stabilizing the area by providing protection against flood flows. Dykes on the east and west banks guard against high and turbulent river flows. On the north side an earthfill dam with control gates guards against high lake elevations and yet provides water for the channel.

The second task was to optimize spawning conditions in the channel to permit maximum survival of eggs and fry. The channel bed was excavated to grade and an even mat of spawning gravel, screened from a nearby bar, was laid throughout the channel length. The depth of the channel was carefully selected to ensure a favorable inflow of groundwater; utilization of this supplementary water flow should have a significant impact on egg-to-fry survival.

Excavation within the wetted perimeter on any watercourse can create a serious environmental problem due to siltation downstream. Prior to commencement of work, porous berms comprising spawning gravel and filter fabric were constructed at the extreme downstream end of the channel excavation to act as filters for any silt-laden water flowing away from the site. The dual action of settlement and filtering served to yield an outflow of water improved in quality to the satisfaction of the fishery officer. Fry left upstream of the porous berms were trapped, transported by Fisheries personnel and released safely in downstream areas.

Another feature of interest is that deep holes in the channel bed were excavated to create pools, thereby simulating a natural river bed. The purpose of these pools is to provide a holding area for chinook salmon and to provide a refuge from grizzly bear predation.

The Phillips river spawning channel was built in three months, for a total cost of $750,000, and was ready in time to accept returning pink and chum salmon. This channel, when fully utilized, is expected to produce more than 400,000 salmon yearly in excess of current production, with a benefit/cost ratio of 2.3:1.

The Phillips River Project was awarded the 1984 Environmental Engineering Design Award from the Association of Professional Engineers of B.C. in recognition of the care taken during design and construction to minimize environmental impact.

Contact: Jim Wild; Roy McGechaen,
Engineering.

Provincial Status Report

Activities associated with the management of steelhead and anadromous cutthroat trout centered mainly around enhancement, angler surveys and biophysical stream assessments. After years of decline in numbers of cutthroat and steelhead, stocks of these fish are improving, thanks to very conservative harvest regulations and an aggressive hatchery program, which emphasizes the importance of wild native stocks of fish. Nine hatchery facilities (federal, provincial, public involvement) now supply steelhead and cutthroat smolts and fry to about twenty-four streams and sloughs in the region. Angler use on important steelhead and cutthroat waters is increasing, especially on streams that contain hatchery fish.

Tenderfoot Creek hatchery has now produced its second brood year of steelhead fry for stocking of the Cheakamus River mainstem and Ashlu Creek. Assessment of stream capacity for steelhead continues on the Cheakamus and results will be used to fine tune hatchery fry stocking.

Angler use for steelhead on Squamish system streams is still very low as a result of conservative harvest regulations. However, total catch of steelhead on the Cheakamus is increasing rapidly and angling success on all Squamish streams is at an historic high. First significant adult returns of steelhead to the system from previous fry stocking should occur in the 1984/85 season.

Summer-run steelhead management continues actively on Seymour and Capilano Rivers. As a result of improved returns of hatchery summer steelhead (Capilano hatchery and BCIT's Seymour hatchery) angler use and catch increased dramatically in 1983/84.

Contact: Peter Caverhill, Regional
Fisheries Biologist,
Fisheries Branch, Surrey.

Job Creation Projects

Bowen Island

The Bowen Island Rod and Gun Club sponsored this job creation project to improve salmon habitat in Island streams. The crew was involved in a number of activities on Terminal Creek, including:

- reconstructing a rock wall for general flow control
- installing a culvert and gate valve for flow control to a spawning channel
- constructing a retaining wall for a feeder pool
- creating a spawning channel
- completing construction of a hatchery building.

The crew also transferred 25,000 coho fry from Capilano hatchery and released them in Trout and Killarney Lakes and their associated streams.

Sunshine Coast

Several streams on the Sunshine Coast benefited from this program, including:

- Angus Creek; the crew trapped 7,000 juvenile fish endangered by sedimentation and released them downstream, collected coho and chum brood stock and transferred eggs to Grey Creek
- Soames Creek; spawning habitat was improved, an incubation box was installed, coho and chum fry were transplanted to Roberts Creek
- Wilson Creek; operation of the fish ladder was improved, habitat improvement was carried out, the hatchery shed was renovated, two incubation boxes were installed; 40,000 coho and 50,000 chum were incubated
- Wakefield Creek; built two incubation boxes, installed above-ground waterline and rearing trough
- Ouellette Creek; repaired incubation boxes and waterline, installed broom-stick fence for brood stock collection, helped construct hatchery building
- Lions Park Creek; installed a rearing trough.

In the fall, the job creation crew counted spawning coho and chum in several Sunshine Coast streams. They also removed logjams and did general bioreconnaissance work.

Powell River Fish Fence

The Powell River Salmon Society sponsored a crew to help improve the hatchery operation on Lang Creek. Workers built a fishway on Kelly Creek to enable coho salmon to utilize upstream habitat. They also constructed a fence, sill and trap on Lang Creek to monitor juvenile coho out-migration. The hatchery site was cleared and seeded with grass.

Sliammon Hatchery

The Sliammon Indian Band sponsored this job creation project to assist with improvements to the hatchery the Band operates near Powell River. The workers repaired the foundation for the two coho rearing ponds, made informational signs, improved the water intake at the lake, constructed a storage box, removed logjams at the lake outlet, and cleared streamside trails. They also assembled prefabricated sea pens for rearing coho in Okeover Inlet.

There was a biological training component to this project. Workers learned how to build a counting fence and to count adult fish going through. They helped regular hatchery staff in nose-tagging and fin-clipping of coho fry, in Petersen disk tagging of adult chum salmon, and in coho/chum egg-takes and fertilization procedures.

Bute Inlet Stream Reconnaissance

The nine-person crew conducted preliminary reconnaissance of the Orford River system in Bute Inlet. They removed logjams on two tributaries of the Orford and conducted physical, chemical and biophysical studies in the area including the recording of:

- air temperature and precipitation, daily
- ocean temperature and salinity, weekly

- stream temperature, flow rates, relative water heights and turbidity, twice weekly.

They analysed water samples from the Orford River east fork and a groundwater source. They also conducted biological studies on fish populations, primarily chum salmon.

The workers completed an incubation and rearing facility and monitored the quality of the facility's water supply on a daily basis.

Scott Cove Hatchery

A job creation crew was employed to assist the hatchery supervisor in enhancement activities. The crew helped renovate the hatchery, including:

- installing a new waterline
- pouring concrete for a floor for the hatchery building and for walkways
- installing 32 Heath trays
- building three net partitions for adult holding tanks
- painting the exterior of the building and ramp.

In the fall, the workers captured 65 adult coho brood stock from area streams. Ninety thousand eggs were taken and planted in the Heath trays. Approximately 300,000 chum eggs were also incubated. For better access to streams, the crew cleared trails. Workers also constructed a pumphouse and a log float and cleared underbrush in the foreshore area.

Little Campbell River

The crew on this project assisted the Semiahmoo Fish and Game Club in improving its enhancement facility on the Little Campbell River in Surrey. They repaired counting fences, cleared trails near the stream, installed Heath trays and a drainage trough in the hatchery building, constructed and repaired fences around smolt ponds and the aeration tower, improved the trapbox, constructed an overflow spillway beside the counting fence, installed plumbing for flow control of the rearing ponds, and built a gazebo.

Contact: Chris deHurussoczy Wirth,
Head, Employment Development
Program.

Table 1

Public Participation Projects

SOUTH COAST PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Richards Creek	Buntzen Bay Residents Association	6	5	incubation	coho	20,000	80	240
McCartney/ Maplewood Creeks	The Sun/North Vancouver School District	3,000	4	45 classroom incubators	coho coho	13,500 11,000	90 77	162 315
McKay Creek	North Shore Fish & Game Club	20	5	incubation	coho	21,000	84	252
Noons Creek	Brian Waite	4	6	incubation, rearing	coho	25,000 juveniles being reared for release in spring 1985. Expected adult production is 3,750.		

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Terminal Creek	Bowen Island Rod & Gun Club	10	2	incubation, rearing	coho	25,000	95	600
Nelson/ Rodgers Creek	The Sun/West Vancouver School District	200	4	15 classroom incubators	coho	12,000	96	144
					coho	8,000	64	96
Upper Paradise Channel/ Shovelnose Creek	The Sun/North Vancouver Outdoor School	3,000	4	incubation, rearing	chum	65,000	93	520
					coho	10,000	24	150
						High mortality due to blocked water source.		
					coho	3,480 juveniles being reared at Tenderfoot hatchery for release in spring 1985. Expected adult production is 392.		
Hyde Creek	George Pearkes Secondary School	90	6	incubation, stream improvement	chum	5,000	20	40
						High mortalities due to frozen waterline.		

Contact: Gary Taccogna, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Wilson Creek	Gibsons Wildlife Club	20	6	incubation, rearing	coho	16,000	80	240
					chum	16,000	73	128
Roberts Creek	Granthams Wharf Rec. Association	15	4	incubation	chum	46,000	96	920
Ouellette Creek	L & K Lumber Ltd.	20	7	incubation	chum	40,000	80	256
					coho	2,250	75	27
Wakefield Creek	Sechelt Rod & Gun Club	10	6	incubation	coho	31,200	96	374
Anderson Creek/ Mixal Creek	Pender Harbor Wildlife Society	20	6	incubation, rearing	chum	52,500	97	420
					coho	38,000	95	570

SOUTH COAST PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Scott Cove Creek	Broughton-Gilford Island Project	40	3	hatchery	coho	6,300	18	95
						Washed out intake caused heavy losses at alevin stage.		
Simoom Sound Creek	Bill Proctor	3	1	incubation	chum	18,800	94	150
Contact: George Bates, SEP Community Advisor.								
Myrtle Creek	Myrtle Creek		1	incubation	coho	5,700	95	68
Anderson Creek	Pender Harbour Secondary School		1	classroom incubation	coho	25	17	0
Anderson Creek	Pender Harbour Alternate School		1	classroom incubation	coho	150	68	2
Pender Harbour area creeks	Sunshine Coast Christian School		1	classroom incubation	coho	20	13	0
Grey Creek	Tuwanek Project		1	fry release	chum	3,500	80	28
					coho	9,000	87	108
					pink	20	2	0
					Pink mortalities due to fungus.			
Whittall Creek	Whittall Creek		1	fry release	coho	1,344	27	40
					chum	65,000	89	520

Contact: Grant McBain, SEP Community Advisor.

Table 2

South Coast SEP Facilities*: Juvenile Releases 1984

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Capilano Hatchery						
Chinook	1983	BQR+Cap.	1,611,857	22	N/A	5.5
Coho	1982	Capilano	503,566	32	N/A	17.8
Coho	1983	Capilano	85,376	0	N/A	0.4
Coho	1983	Capilano	223,330	0	N/A	2.0
Coho	1983	Capilano	192,442	0	N/A	11.5
Steelhead	1982	Capilano	112,883	0	N/A	70.4
Steelhead	1982	Capilano	14,314	0	N/A	5.0
Steelhead	1983	Capilano	10,906	0	N/A	33.4
Steelhead	1984	Capilano	121,695	0	N/A	2.1
Seymour River Hatchery						
Not available at time of printing.						
Tenderfoot Creek Hatchery						
Chinook	1983	Tenderfoot	142,013	64	79	5.0
Coho	1982	Tenderfoot	94,980	72	N/A	19.6
Steelhead	1984	Tenderfoot	100,018	0	N/A	0.7
Side Channel Projects						
Judd Slough						
Chum	1983	Squamish	1,000,000	--	--	--
Coho	1983	Squamish	50,000	--	--	--
Upper Paradise						
Chum	1983	Squamish	800,000	--	--	--
Coho	1983	Squamish	23,400	--	--	--
Lower Paradise						
Chum	1983	Squamish	350,000	--	--	--
Mamquam						
Chum	1983	Squamish	1,500,000	--	--	--
Coho	1983	Squamish	50,000	--	--	--
Sechelt Community Development Project						
Not available at time of printing.						
Vancouver Bay Project						
Not available at time of printing.						
Sliammon Hatchery						
Not available at time of printing.						
Powell River Salmon Society						
Not available at time of printing.						

* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 3

South Coast SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Capilano Hatchery							
Steelhead	summer run	84	fry	10,540	May 1986	10,000	Capilano
Steelhead	winter run	84	fry	18,455	May 1986	18,000	Capilano
Steelhead	summer run	83	yearling	10,993	May 1985	10,900	Capilano
Steelhead	winter run	83	yearling	1,882	May 1985	1,880	Capilano
Cutthroat	Capilano	84	fry	1,478	April 1985	1,400	Brothers
Coho	Capilano	83	presmolt	1,550,024	June 1985	500,000	Capilano
					Apr.- June '85	500,000	upper watershed
					Mar.- June '86	500,000	Expo 86 program
Chinook	Capilano	84	egg	2,285,627	June 1985	1,600,000	Capilano
					June 1986	600,000	Capilano
Coho	Capilano	84	egg	2,003,341	June 1986	500,000	Capilano
					Sept.- Dec. 1985	253,000	upper watershed
					Jan. 1985	950,000	fish farmers
					Jan.- Apr. '85	200,000	research
Seymour River Hatchery							
Coho	Seymour	84	egg	178,000	May 1985	100,000	Seymour
Coho	Seymour	83	smolt	35,500	June 1985	30,000	Deep Cove
Cutthroat	Seymour	84	fry	800	May 1985	800	Seymour
Steelhead	Seymour	83	smolt	5,500	May 1985	5,000	Seymour
Steelhead	Seymour	84	fry	28,000	N/A	N/A	N/A
Tenderfoot Creek Hatchery							
Chinook	Tenderfoot	84	egg	250,000	May 1985	70,000	hatchery
					May 1985	70,000	hatchery
					June 1985	70,000	hatchery
Coho	Tenderfoot	83	fry	333,000	May- June '85	318,000	hatchery
Coho	Mamquam	83	fry	54,000	May 1985	53,000	Mamquam
Coho	Squamish	83	fry	14,000	May 1985	14,000	Squamish
Coho	Tenderfoot	84	egg	200,000	1986	180,000	hatchery
Coho	Mamquam	84	egg	100,000	1986	90,000	Mamquam
Coho	Squamish	84	egg	25,000	1986	23,000	Squamish
Sechelt Community Development Project							
Chinook	Sechelt	84	alevin	68,000	June 1985	25,000	sea pens
					June 1986	12,500	sea pens
					June 1986	12,500	sea pens
Coho	Sechelt	84	alevin	85,000	June 1986	45,000	sea pens
					June 1986	15,000	sea pens
					April 1985	25,000	sea pens
Chum	Sechelt	84	alevin	58,000	April 1985	46,000	Angus Cr.

Table 3 (Cont'd)

South Coast SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Expected Release Site
Vancouver Bay Project							
Chum	Jitco	84	egg	173,036	N/A	N/A	N/A
Chum	Jervis Inlet	84	egg	58,101	N/A	N/A	N/A
Coho	Jitco	84	egg	95,648	N/A	N/A	N/A
Coho	Jitco	83	fry	3,000	N/A	N/A	N/A
Chinook	Capilano	84	egg	25,068	N/A	N/A	N/A
Sliammon Hatchery							
Coho	Sliammon	83	fingerling	5,024	May 1985	4,900	Sliammon L.
Coho	Sliammon	84	alevin	70,613	May 1986	35,000	Sliammon L.
Chum	Sliammon	84	alevin	1,110,760	May 1985	1,100,000	Sliammon R.
Powell River Salmon Society							
Coho	Lang Cr.	84	egg	178,089	May 1985	70,000	Haslam L.
					June 1985	50,000	Haslam L.
					June 1985	40,000	Haslam L.
Chum	Lang Cr.	84	egg	56,000	April 1985	55,000	Lang Cr.
Coho	Kelly Cr.	84	egg	10,026	Oct. 1985	10,000	Kelly Cr.

* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 4

South Coast SEP Facilities: Surplus Sales 1984*

Species	Number Eggs/Juv.	Stage	Disposition	Value ($)	Surplus Adult Sales (kg)	Value ($)
Capilano Hatchery						
Chinook	2,412	egg	sales	24.12	82.10	58.30
Chinook	30,909	egg	research	--	--	--
Coho	21,475	egg	research	--	17,983.19	14,115.45
Coho	1,076,819	egg	sales	15,075.47	--	--
Mixed[1]	--	--	--	--	8,272.30	330.90

* Includes facilities constructed prior to SEP.
[1] Coho and chinook sold together.

Table 5

South Coast SEP Facilities: Escapement to Facility 1984*

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked (male and female)
		male	female	
Capilano Hatchery				
Coho (adult)	15,559	950	1,465	19
Coho (jack)	1,381	--	--	22
Chinook (adult)	1,694	537	688	15
Chinook (jack)	139	--	--	20
Chum	3	--	--	33
Steelhead (summer run)	16	--	--	56
Seymour River Hatchery				
Not available at time of printing.				
Tenderfoot Creek Hatchery				
Chinook	--	55	38	10
Coho	1,000+	30	57	10
Sechelt Community Development Project				
Chinook	500	--	--	100
Vancouver Bay Project				
Not available at time of printing.				
Sliammon Hatchery				
Chum	--	218	427	0
Coho	--	31	38	0
Powell River Salmon Society				
Coho (Lang Cr.)	--	151	144	0
Coho (Kelly Cr.)	--	10	9	0
Chum (Lang Cr.)	--	15	27	0

* Includes facilities constructed prior to SEP.

Table 6

South Coast SEP Facilities: Adult Production*

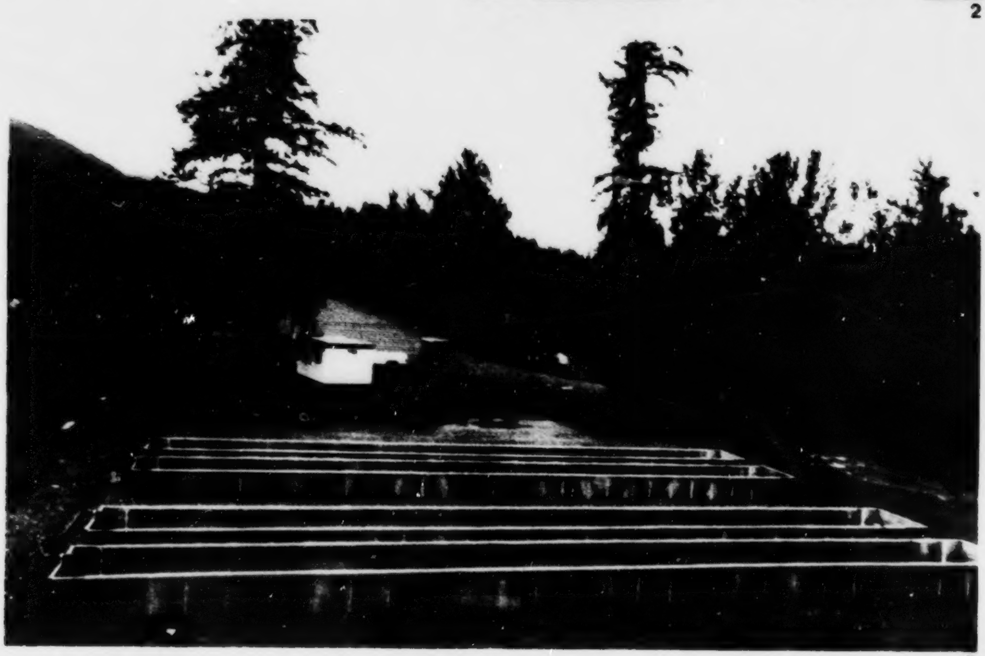
	Expected Production from 1984 Releases			At Full Production		
Species	Total Adult Production	Years of Return	Contribution to Fisheries (pieces)	Total Adult (pieces)	Contribution to Fisheries (pieces)	Contribution to Fisheries (lbs)
Capilano Hatchery						
Chinook	48,356	1985-88	35,408	67,000	49,016	328,591
Coho	80,031	1984-86	28,880	167,000	60,287	270,164
Steelhead	1,358	1986-90	700	760	380	3,914
Seymour River Hatchery						
Not available at time of printing.						
Tenderfoot Creek Hatchery						
Chinook	4,260	1985-88	3,146	24,300	11,733	78,657
Coho	14,247	1984-85	5,126	40,500	24,745	130,319
Steelhead	641	1987-91	300	500	250	2,575
Sechelt Community Development Project						
Not available at time of printing.						
Vancouver Bay Project						
Not available at time of printing.						
Sliammon Hatchery						
Not available at time of printing.						
Powell River Salmon Society						
Not available at time of printing.						

* Includes facilities constructed prior to SEP.

1

1. The Chehalis River hatchery modified operations in 1984 to overcome problems with sand in its rearing channels. Chum production for 1984 was 136 percent of target.
2. The Jones Creek spawning channel near Hope has been in operation since 1954.
3. Clearwater hatchery began operation in 1984. It, along with three other projects nearby, is designed to assess potential for enhancement in the North Thompson watershed.

2



3

Fraser River

Inch Creek Hatchery

The Inch Creek hatchery is located 12 km east of Mission and is mainly a chum and coho salmon facility. The hatchery has a capacity to incubate nine million chum and one million coho. Rearing space is available to extended rear 0.5 million coho salmon to a 20 g size. This year at Inch Creek, the following numbers of eggs were collected:

Blaney Cr. chum - 1.2 million
Blaney Cr. coho - 95,000
Stave R. chum - 5.4 million
Inch Cr. chum - 2.4 million
Inch Cr. coho - 126,000
Norrish Cr. coho - 90,000
Nicomen Slough coho - 85,000
Siddle Cr. coho - 75,000

Thirty thousand cutthroat trout were also received from the Fish and Wildlife Branch. These trout will be released in May and June of 1985 into streams from Deroche to New Westminster.

This year at Blaney Creek, the chum run was much larger than normal with escapement being upwards of 3,000 adults; however, the egg target was reduced to one million chum eggs. Some refinements were made to the Blaney Creek fence trap this year including an aluminum grating walkway and planking over the trap.

On the Stave River, all chum adults beach-seined for brood stock were transported back to the Inch Creek hatchery by truck. Adults were held in deep concrete raceways until mature and all egg-takes were done on site.

The Inch Creek chum run was the largest on record with an estimated escapement of 17,000 adults. Chum adults were collected at the fence trap and all adults thrown over the fence swam upstream to the hatchery. A few thousand adults spawned in the renovated overflow channel.

Coho escapements in the area were better than in the last few years and the marked jack return to Inch Creek was the largest to date. The numbers of returning marked chum and adult coho also increased compared to previous years.

This year, 50,000 Birkenhead River chinook salmon were incubated and reared at Inch Creek hatchery. The objective was to make use of the warm water supply at Inch Creek hatchery to incubate and rear the chinook to as large a size as possible before March 1985. The chinook reared at Inch Creek will receive a separate tag code which will be used to evaluate the difference in survivals between the large (Inch) and small (Birkenhead) chinook.

On January 4, 1984, Inch Creek hatchery was inundated by Norrish Creek floodwaters. Although fish losses occurred, they were kept to a minimum. Some damage to the hatchery also occurred but has since been remedied.

Contact: Bill Foye, Stock Enhancement
Officer, Enhancement
Operations.

Alouette River Hatchery

The Alouette River hatchery is located at the Alouette River Correctional Center on the South Alouette River, 10 km northwest of Haney. The hatchery project was initiated to provide meaningful work for inmates and to help build up the salmonid stocks of the Alouette River. The project is operated as a joint venture between the Small Projects Unit of the Special Projects Division of SEP, and the Corrections Branch of the B.C. Ministry of Attorney General. The Fisheries Branch of B.C. Ministry of Environment uses the hatchery for rearing of sea-run cutthroat and steelhead trout. In addition, in fall 1983, the International Pacific Salmon Fisheries Commission used the hatchery for an experimental introduction of pink salmon from Harrison River stock.

In 1984, between 500,000 and 800,000 Harrison River brood pink fry were released at the end of March; 147,000 Alouette River brood '83 chum fry at 2 g in early April; 32,800 Alouette River brood '82 coho smolts at 24 g from late May to early June; and 28,000 brood '83 steelhead smolts at 60 g from late May to early June. In addition, as part of a continuing volunteer program by the Sapperton Rod and Gun Club to re-establish a coho run to the Brunette River, 11,000 Salmon River brood '82 coho smolts were incubated and reared at the hatchery and released to the Brunette system in May 1984.

Some problems were encountered during spring 1984 operations. As a result of various water stoppages, all 5,500 Alouette brood '83 coho and about 40,000 of 45,000 Chilliwack River brood '83 coho (the latter destined for the Brunette River) were lost. In July, an additional 50,000 Chilliwack brood '83 coho fry were received from Chilliwack hatchery as replacements for the group destined for the Brunette River. Of these 10,000 were released at 8.5 g in September, and 20,000 were released at 10 g in October to the Brunette system.

Following a surplus coho egg-take at Chilliwack hatchery, a further group of approximately 120,000 brood '83 fry were transferred to Alouette hatchery in order to take advantage of available rearing space. They will be marked as part of the "Expo" coho group with a right ventral clip, and returned to the Chilliwack system in May 1985.

In early May 1984, 34,500 brood '84 cutthroat trout fry were received at approximately 2 g from Fraser Valley trout hatchery. These were supplemented in late June with an additional 4,900 fry. In August 1984, 30,000 steelhead trout fry were received from Fraser Valley trout hatchery and supplemented in September with 15,000 more.

In fall 1984, the hatchery came the closest ever to achieving its egg targets for chum and coho (1.3 million and 140,000 respectively). Like most other lower Fraser River tributaries, the Alouette River enjoyed two good chum escapements in 1984. Approximately 1,240,000 brood '84 Alouette chum eggs were taken. Coho eggs taken from the Alouette numbered approximately 90,000. In addition, some 27,000 eggs were taken by volunteers of the Sapperton Rod and Gun Club from the recovering Brunette River brood coho. These were later supplemented with 26,000 eyed coho eggs from Chilliwack hatchery for a total of 53,000 coho eggs destined for release to the Brunette system in 1985/86.

As part of an overall plan to move the Alouette hatchery from a developmental to an operational phase, some construction and site modification was carried out in 1984. Small Projects Unit staff directed the design and installation of a stream intake and a 850 m gravity feed water supply system from Mike Lake Creek, a small tributary to the Alouette River upstream of the hatchery site. This new supply will be used in conjunction with the existing well supply to control incubation and rearing temperatures to achieve optimum developmental timing and growth. Additional construction and modifications included: an aeration tower and distribution system for the Mike Lake Creek source; double plumbing to rearing troughs; consolidation of all incubation and rearing to the lower (left track of the river) site; and plumbing to the two large production earthen ponds.

Finally, in October 1984 a committee was formed to coordinate future activities at the site. An operational plan was adopted which meets management production goals for enhanced stocks of the Alouette system and should allow for the safe and most efficient ongoing use of the facility by the various groups concerned.

Contact: Greg Bonnell, Biologist,
Small Projects Unit.

Fraser Valley Trout Hatchery

Fraser Valley Trout hatchery is operated by the Provincial Ministry of the Environment and produces a variety of trout species, with emphasis on rainbow, cutthroat and steelhead. More than twenty different stocks or races are handled during a typical year. About one-half of the hatchery's production is for SEP projects while the other half consists of non-anadromous trout stocks for lake management programs.

In 1984, eleven stocks of steelhead and three stocks of anadromous cutthroat trout were incubated and reared at Fraser Valley trout hatchery. The majority of these fish was released as fry while the balance was retained for smolt production. Heated or chilled water can be used to accelerate or decelerate growth during incubation and rearing to ensure goal sizes are reached for both fry and smolts.

Audio-visual presentations, technical displays and aquaria attracted 15,600 visitors to the public display area at the hatchery in 1984 (this represents a drop of 48 percent from 1983 figures). Both guided and self-guided tours of the display are available from Sunday to Thursday of each week.

Anadromous cutthroat and steelhead brood stocks required for fry and smolt stocking programs were collected in various ways. Electro-shocking has been the main method of collecting cutthroat from small Fraser River and Nicomekl River tributaries. Angling is the predominant method of capturing steelhead from large streams, although seining, trapping and electro-shocking are all used in some instances. The Coast Steelheaders again were the major contributors of brood stock from the Squamish River system. B.C. Corrections Branch inmates and staff provided assistance with seining the South Alouette River for steelhead. Kanaka Creek steelhead and anadromous cutthroat were obtained from the fish fence on Kanaka Creek, from angling volunteers, as well as from electro-shocking by the SEP Public Involvement Section. Green eggs from two northern steelhead stocks (Morice and Suskwa Rivers) were flown from Smithers for incubation and rearing at Fraser Valley trout hatchery.

The number of anadromous fish produced in 1984 was down slightly from the previous year; this was due mainly to reduced numbers of northern steelhead fry produced.

Anadromous smolt production has risen slightly over previous years. This is a result of further expansion at Correction Branch's Alouette River Corrections Unit to provide increased rearing for steelhead and anadromous cutthroat. Production at this site will approach 75,000 smolts in 1985. Increased anadromous cutthroat smolt production at Fraser Valley trout hatchery is due to the termination, in 1983, of a smolt production contract with Bakerview Trout Farm in Surrey. As a result, anadromous cutthroat destined for the Semiahmoo and Mud Bay drainages are now being reared at Fraser Valley trout hatchery.

The operation of the anadromous cutthroat smolt rearing program at Loon Creek hatchery has been turned over to the Department of Fisheries and Oceans. Fraser Valley trout hatchery will capture adults, incubate eggs, rear and transfer the resulting fry to Inch Creek staff who will be responsible for taking the fish to the smolt stage. Fraser Valley trout hatchery staff will be involved in the smolt releases at the conclusion of the rearing period.

Contact: Don Peterson, Hatchery
Supervisor, Fraser Valley
Trout Hatchery, Abbotsford.

Chilliwack River Hatchery

The Chilliwack River hatchery is situated at the confluence of Slesse Creek and the Chilliwack River, 19 km upstream of Vedder Crossing and 32 km southeast of the city of Chilliwack. Major construction was completed by April 1981, and the facility has been operated since that date.

In 1984, the existing overflow channel was developed into a 2,265 m^3 earthen rearing channel to increase coho production by one million smolts for Expo 86. Three concrete intermediate rearing raceways were also added.

A total of 2.4 million coho fry were ponded into the two earthen rearing channels for an anticipated release of 2.2 million coho smolts. All of these fish are being marked with a right ventral clip as well as the regular production CWT mark. The chum salmon egg target for 1984 was reduced from 5 million to 4.2 million to permit lower density loading of keeper channels. This was done to overcome the problem of bacterial gill disease that had been encountered at the higher density loadings of previous years.

As in 1983, 1.5 million chinook eggs were transported from the Harrison River via Chehalis River hatchery.

The first return to Chilliwack hatchery of 3-year-old Harrison chinook provided an additional 180,000 eggs.

The first return of hatchery produced 2-ocean steelhead was very good with excellent sportfishing success reported from January to April. The sport release technique used by the provincial Fish and Wildlife Branch seems to delay the steelhead in the lower reaches of the river, making them more available to anglers.

Excellent catches of both wild and hatchery 3-ocean steelhead were being taken in the late December sport fishery. A very high percentage of the catch has been large 3-ocean hatchery fish, one at 9.98 kg has been recorded as well as several at over 9 kg.

Chilliwack hatchery staff continue to supply eggs, fry and expertise to Public Involvement Projects in the area, including Centre Creek Correction Camp, Little Chilliwack River Enhancement Project, and Chilliwack Senior Secondary School as well as the Alouette Corrections CEDP Project.

An open house was held at the hatchery in the fall in conjunction with the DFO Public Awareness Campaign. The open house attracted about 600 people. Tours were given and a display was set up in the workshop.

Staff also participated in the "Fish Fest" event in the Cottonwood Shopping Mall in Chilliwack. A display was set up that incorporated live juvenile fish, a static display of adult salmon, and an audio display. This display was staffed for three days.

Problems

The acquifer of the major production well continued to decline in 1984 requiring a reduction of 40 percent in the pumping rate. This has resulted in greatly reduced growth for juvenile steelhead.

This problem has been addressed by Engineering and a new well will be drilled in spring, 1985.

Bacterial gill disease was a major problem in chum salmon fry in 1984 with a 17 percent loss from ponding to release. This situation will be dealt with in 1985 by changing gravel size and reducing loading in the keeper channels.

There was some loss of juvenile fish from the new rearing channel due to escapements. Temporary action has been taken and Engineering will carry out permanent repairs in the summer, 1985.

Contact: Don Buxton, Stock Enhancement
Officer, Enhancement
Operations.

Chehalis Band Project

The Chehalis Band project is located on the Harrison River just upstream of the Chehalis Harrison River confluence.

This upper Fraser Valley program provides 4.5 person years employment to Band members in fish culture and habitat improvement techniques.

At present, the focus is on production of chum from two improved side channels and five incubation pits. Initial results of 500,000 eyed eggs from Smokehouse hatchery planted into the pits are favourable. A total of 1.5 million chum eggs were taken for planting into the upwelling pits.

Habitat improvement work continued in the 3B channel of the Chehalis River area after the mechanical removal of 20 beaver dams.

Removing these obstructions allowed access to chum spawners and also reduced the silt load over upwelling groundwater areas.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Chehalis River Hatchery

The Chehalis River hatchery is located approximately 95 km east of Vancouver near Harrison Mills. The hatchery is adjacent to the lower Chehalis River 3 km upstream from its confluence with the Harrison River. The facility has a capacity of 14 million chum eggs, 3 million chinook eggs, 750,000 coho eggs, 240,000 steelhead eggs, and 42,000 cutthroat eggs. A mixture of conventional and Japanese-style hatchery methods are used at the site. The Chehalis River hatchery has been in operation since October 1982.

The second release of juvenile chinook and chum salmon from the hatchery was made in spring, 1984. Releases were 75 percent and 136 percent of full production targets, respectively. The first release of coho, steelhead, and cutthroat smolts was also made in spring 1984. These releases were 78 percent, 59 percent and 20 percent respectively of full production targets. Some problems have been encountered at Chehalis during the initial incubation and rearing of cutthroat trout and Harrison River chinook. These problems appear related to water quality and possibly to disease. Research is presently being conducted in an attempt to determine the cause.

Steelhead and cutthroat brood stock capture and egg collections in spring 1984 resulted in collection of approximately 100,000 steelhead eggs and 15,000 cutthroat eggs.

Fall brood stock collection in 1984 was highly successful. Full production egg targets for chinook and chum salmon were either met or exceeded. Most of the brood stock capture was carried out under contract by the Chehalis Indian Band. Fish were seined, gillnetted or trapped on the Harrison and Chelalis rivers as well as on a number of smaller tributaries. After capture most of the fish were transported by hatchery staff to the hatchery for holding and egg-takes. In total, 14.4 million chum eggs, 3.1 million chinook eggs and 448,000 coho eggs were collected.

Tourists continued to visit Chehalis River hatchery in large numbers in 1984. A marked increase in the number of sport fishermen on the Chehalis River was also observed in 1984, especially during the hatchery's first coho returns (jacks) in the fall.

Operational problems continued to be worked out at Chehalis River in 1984. Engineering modifications greatly reduced major problems with sand in the rearing channels.

The Chehalis River hatchery is designed to produce increased commercial, freshwater and saltwater sport, and Indian food fishery catches of approximately 150,000 chum, 58,000 chinook, 48,000 coho, 4,000 steelhead and 3,000 cutthroat trout.

Contact: Larry Kahl, Stock Enhancement Officer, Enhancement Operations.

Seabird Band Project

The Seabird Band project is located on Maria Slough, in the upper Fraser Valley. The Band's repeated attempts to become involved in the SEP program were partially met by the construction of a chum spawning channel. Capital funds from CEDP and labour provided by federal job creation combined with technical support from Small Projects personnel led to the development of a $500m^2$ channel on the boundary of the Band reserve and Maria Slough. The channel was completed in time for the chum run. An adult trap was constructed to aid in enumeration and obtaining of spawners to seed the new channel. Coho bound for Hicks Creek were also collected at the trap and held for pick up by the Chehalis River hatchery.

Contact: Ian Shand, Project Coordinator, Special Projects Division.

Jones Creek Spawning Channel

The Jones Creek spawning channel is located approximately 16 km southwest of Hope, B.C. The channel was constructed in 1954 as a solution to salmon problems created by a hydroelectric development at Jones (Wahleach) Lake. The Wahleach hydroelectric project of the B.C. Electric Company (now B.C. Hydro and Power Authority) resulted in the diversion of a large proportion of the natural water flow from Jones Lake into penstocks at the Wahleach power generating station located 13 km downstream from the mouth of Jones (Wahleach) Creek, adjacent to the Fraser River. In order to compensate for the impact of reduced and irregular flows, the B.C. Electric Company constructed the channel adjacent to lower Jones Creek according to Department of Fisheries' specifications. The company agreed to maintain the channel and provide sufficient flow to ensure its successful operation. The operation of the channel has been carried out by the Department of Fisheries and Oceans. An average of 2,000 pink salmon utilize the channel in the odd years. A few chum salmon and the occasional coho also use the channel. The optimum number of spawners for the channel appears to be about 2,050 pinks.

In 1984, samples of pink, chum, and coho fry were captured in a 2 x 3 inclined plane trap as they migrated from the channel. The total migration was estimated from these samples. Approximately 166,500 pink fry, 69,750 chum fry, and 1,990 coho fry were produced. These low numbers were due mainly to low spawning escapements in 1983 (332 pinks, 145 chums, and 2 coho). Egg-to-fry survivals were estimated at 44 percent for pink salmon, 33 percent for chum, and 79 percent for coho (1 female coho). These survivals are considered to be good, since the channel was subjected to extreme icing in late December 1983 and then flooding, scouring, silting and temporary flow stoppage in early January 1984. The 1984 fry migration began on March 22, peaked in late April-early May, and tapered off in late May and early June. Channel temperatures were 4-5°C when the migration began, 5.5-6.5°C at the peak, and 6-7°C near the end.

The estimated contribution to commercial fisheries is 3,068 pink salmon and 248 chum. Returning escapements to the channel are expected to number 1,100 pinks and 300 chum.

Contact: Larry Kahl, Stock Enhancement Officer, Enhancement Operations.

Birkenhead River Hatchery

The Birkenhead River hatchery is located approximately 2 km north of Mount Currie on the east bank of the Birkenhead River. The capacity of the present facility is 250,000 fry and it has been in operation since 1979. During the two years preceeding that, small numbers of chinook fry were incubated in an upwelling gravel incubator and reared for a short term before release.

In spring 1984, 197,000 chinook fry (1983 brood) were reared and released into the Birkenhead River. The entire group, composed of 154,000 Birkenhead reared fry and 43,000 Inch Creek reared fry, were placed in a large pond which left them free to leave and enter the river at will. The Inch Creek group was part of a successful study on the feasibility of rearing chinooks at Inch Creek if excess eggs should become available and to determine if larger fry of the year have a greater success rate than smaller fry of the same year.

Chinook broodstock capture was almost entirely by angling and a small amount of gillnetting. The 46 adults were held for up to three months until ripe. Approximately 150,000 eggs were taken and 60,000 eyed eggs were transferred to Inch Creek to evaluate the possibility of taking advantage of the warmer water temperature for incubation and initial rearing. Resulting fry will be returned to Birkenhead in early spring, tagged (CWT) separately from the other fry and released into the river along with the remaining group of Birkenhead-reared fry.

Approximately 40,000 coho eggs were taken for hatchery stock. Still on hand are 27,000 coho fry from the 1983 brood. These are due for release in the spring of 1985.

Contact: Bill Foye, Stock Enhancement
Officer, Enhancement
Operations.

North Thompson Reconnaissance/Feasibility

A summary report is now available on water quality and temperature in the North Thompson area, including:

a) Finn Creek

Finn Creek discharges into the North Thompson River 16 km north of Avola. The artesian-flow well system developed at this site in 1982 has potential as a small incubation/rearing facility, perhaps implemented as a public involvement project.

b) Mahood River

Mahood River flows into the Clearwater River 35 km north of Clearwater. A well that was developed in 1981 was sampled with regard to water quality and monitored for temperature. It probably would be suitable for intensive culture of salmonids. However, this site could only be economically developed as a major facility, and may not be necessary if the Clearwater pilot facility proves successful.

c) Clearwater River

Sampling of new wells drilled for the pilot facility and of two existing wells belonging to local residents in the town of Clearwater was reported on.

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations.

Eagle River Hatchery

The hatchery is located 32 km east of Sicamous, B.C. on the Trans Canada Highway. The Eagle River hatchery was expanded in 1984. The hatchery building was enlarged to provide office space, a wet laboratory, workshop - storage areas, roofed intermediate rearing, a walk-in freezer and a marking and storage room. In addition, a second well was brought on line, with an enlarged aeration tower, and six more concrete raceways were constructed. The facility is now capable of incubating a total of 2.5 million eggs as well as rearing chinook to 5 g size and coho to 2 g, for release in April and May, respectively.

Chinook brood stocks were captured at fence traps from the Eagle and Salmon rivers and by angling from the Shuswap River in fall 1984. Coho brood stock were collected from the Eagle and Salmon Rivers. Each stock is reared separately and each will be transported back to their respective natural streams for release.

The objective of this facility is to increase future chinook escapements to the Eagle and Salmon Rivers and to study the effects of releasing 2g coho fry into the underutilized rearing areas of these rivers. An extensive coded-wired tagging and post-release assessment program is planned for spring and summer 1985.

Contact: Dick Harvey, Stock
Enhancement Officer,
Enhancement Operations.

Central Interior Tribal Council Fisheries Program

The Central Interior Tribal Council (CITC) is based in Kamloops and is a representative body for the interior tribes from Darcy to the Alberta border; north from near Williams Lake, and south to the U.S. border. Their interest in the fisheries resource has resulted in a project with the Community Economic Development program to attempt to locate and develop salmonid enhancement opportunities throughout the region.

The results of the 1983 program showed potential for further work on several sites with gathering information on life history data, abundance and distribution as some of the main goals.

The program has succeeded in increasing Native community awareness of salmonid enhancement opportunities and fisheries practices in general. It has employed one full-time biologist and technician and up to four part-time technicians.

The feasibility aspect of the program will be complete by 1986 and Native communities will be able to use this information to develop enhancement programs.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Loon Creek Hatchery

Loon Creek hatchery, near Cache Creek, is operated by the Province of British Columbia, Ministry of Environment. It is involved in SEP for the initial purpose of raising 150,000 chinook salmon fry and 40,000 steelhead smolts for the enhancement of the Bonaparte River.

In 1984, adult steelhead were to be captured from the Bonaparte River using a broomstick fence but high water conditions made it impossible to install the fence. Adult donor stock (30 females and 7 males) from Deadman River was held in isolation boxes at Loon Creek hatchery and substituted for Bonaparte stock to achieve smolt goals. About 268,713 eggs were collected from 29 females. About 168,000 unmarked fry were released into the Bonaparte River in July 1984 and an additional 12,200 marked fry were released into the Bonaparte River in October 1984. About 42,800 fry were kept for 1985 smolt releases. All smolts will be identified by coded-wire nose tags.

Adult steelhead donor stock was captured from the Nicola River (19 females and 8 males) and held at the Loon Creek hatchery in isolation boxes. Two males were lost during holding. All females were spawned yielding 180,179 eggs. From these, 171,800 unmarked fry were released into the Maka, Spius, and Coldwater Creeks in the Nicola River system. All adult steelhead were air spawned and most adults were released back into their natal river after spawning.

Chinook donor stock was angled at the obstruction in the Bonaparte River. The 31 females and 23 males captured were held in earthen ponds and isolation boxes at Loon Creek hatchery. A loss of 7 females was experienced during holding. About 58,067 eggs were taken; all fry (2-4 g) will be identified by coded-wire nose tags and released into the Bonaparte River in April 1985.

Chinook donor stock (36 females and 15 males) was captured from the Deadman River by the Interior Tribal Council and transported to Loon Creek hatchery and held in earthen ponds and isolation boxes. Eight females were lost during holding. All fry (2-4 g) from the 89,024 eggs collected will be identified by coded-wire nose tags and released into the Bonaparte River in April 1985.

This hatchery will continue to be a major component in the provincial freshwater fisheries program, receiving and distributing some 2.5 million trout annually.

Contact: Dennis Graf, Hatchery
Supervisor, Loon Creek
Hatchery, Fisheries Branch.

Quesnel River Hatchery

This major chinook satellite hatchery is located 85 km northeast of 150 Mile House, and 2 km west of Likely, B.C. Construction was completed in summer 1982. The design capacity for this facility is 3.9 million eggs. Its goal is to enhance chinook stocks in the upper Fraser River watershed. It is anticipated that the hatchery will be at full production for the 1985 brood year.

This facility utilizes Heath trays for incubation, aluminum rearing troughs for initial rearing and large cement channels for final rearing. The water supply is well water from three production wells and one test well. No surface river water is utilized.

From April 5 to April 20, all the 1983 brood chinook juveniles were released into the following rivers:

Blackwater R.	-	255,605
Nazko R.	-	161,647
Bowron R.	-	435,242
Indianpoint Cr.	-	86,329
Quesnel R.	-	456,262
Cariboo R.	-	83,846
Horsefly R.	-	23,168
Total		1,502,099

On April 30, a total of 17,974 coho fry were released into McKinley Creek.

The chinook and coho juveniles were released into their native streams where the eggs were collected. All the fry were transported in tanks on flatbed trucks to the release sites. The fry were loaded at a density of 0.24 kg per litre of water (see Info Memo #106).

For some of the locations, the fry were airlifted from the transport truck by helicopter to the release site, depending on road access.

In summer 1984 a new production well was drilled. Unfortunately the well produced only 44 percent of the water volume required. Without additional water, the hatchery cannot reach full productive capacity.

In 1983, the brood stock egg collection program filled the hatchery to 75 percent capacity. The following number of chinook eggs were collected from these donor streams:

Blackwater River	-	293,000
Baezaeko River	-	135,000
Nazko River	-	42,000
Bowron River	-	433,000
Indianpoint Creek	-	164,000
Cottonwood River	-	103,000
James Creek	-	108,000
Fontoniko Creek	-	159,000
Seebach Creek	-	170,000
Quesnel River	-	464,000
Cariboo River	-	247,000
Horsefly River	-	29,000
McKinley Creek	-	19,000
Willow River	-	113,000
Total		2,479,000

On all the streams except the Cariboo River, the donor stock was caught by drifting gillnets on the spawning redds. The eggs and milt were immediately taken and at the end of each day the gametes were flown by helicopter to the hatchery for fertilization and planting. Some Quesnel adults were held at the hatchery for maturation.

An adult coho brood stock collection fence was operated on McKinley Creek. Unfortunately on six male coho were captured and no females were caught.

Contact: Robin Dickson, Stock
Enhancement Officer,
Enhancement Operations.

North Thompson Band Community Project

The North Thompson Band is located near Barrier approximately 100 km north of Kamloops.

The community employs three personnel full time and one part-time to conduct an experimental lake-pen rearing program on Dunn Lake. The object of this program, apart from the employment aspect, is to test the release retionale program for coho from three different streams in the Barrier area.

New lake-pen rearing structures were contructed in early spring 1984, and a temperature control pumping device was completed to deal with high summer temperatures by July.

The lake-pen rearing has been very successful and resulted in release of 60,000 tagged coho in the fall.

Construction of a new incubation box on Dunn Creek was completed to meet requirements of the 1984 brood stock.

In 1985, Fennel Creek, Dunn Creek and Lemieux Creek coho will be reared and tagged then released back to their natal streams.

It is hoped that adult reconnaissance work in 1985 will show some results from the 1982 release of 25,000 coho, reared in Dunn Lake.

Continued assessment will be conducted in this region with the assistance from Central Interior Tribal Council.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Penny Hatchery

The Penny chinook hatchery is located on the north side of the Fraser River, 100 km east of Prince George.

This hatchery has the capacity to incubate and rear 200,000 chinook in Heath trays and alumimum troughs. Water from an existing gravity feed supplies the hatchery with ample water year round.

The hatchery was run from 1980 to 1983 as a pilot for the Quesnel River to try to answer some questions regarding rearing and release of upper Fraser chinook. Budget contraints forced the hatchery to be shut down from July 1983 to July 1984.

The Community Economic Development program started running Penny in July 1984 to develop a community based project. With assistance in brood stock capture and egg-take from the Quesnel River hatchery, the project obtained 190,000 James Creek chinook eggs in August 1984. The intent is to rear these fish to 1.5-2 g, tag and release them into James Creek in July 1985. This will add a much needed year of information for the comparison of accelerated vs cold water rearing and release timing for assessment. A similar number of the same brood stock were rear at Quesnel River.

A dead pitch on Slim Creek was conducted by the Penny personnel to determine if any of the first of the Penny hatchery fish showed up; no tags were found.

Trouble free operation has continued through the winter of 1984.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Deadman River Counting Fence

The Deadman River flows into the Thompson just west of Savona. The salmonid populations have been subject to various studies over the past few years. To avoid the spring freshet problems associated with Criss Creek, a steelhead counting fence was installed above the confluence of Criss and Deadman. It will be operated by the provincial Fisheries Branch.

Current Community Economic Development studies in the area through contract showed a need to gather chinook spawner data for enhancement opportunities investigations. A permanent wooden sill counting fence was installed by the Deadman's Band with combined support dollars from CEDP and job creation programs. The fence is located on reserve land approximately 500 metres upstream from the Thompson River.

The Band also aided the local DFO staff by conducting a dead pitch through the fall and supplied the provincial Loon Creek hatchery with chinook brood stock for restocking back into Deadman in spring 1985.

Contact: Ian Shand, Project
Coordinator, Special Projects
Division.

Stuart River/Necoslie Band Project

During 1984, the Necoslie Band operated the Stuart River pilot hatchery under the auspices of the Community Economic Development Program. The pilot facility, originally developed to test marginal iron concentration in a hatchery water supply, has been operated since October 1983 as a training facility for the Necoslie Band. It is located in Ft. St. James village near the outlet of Stuart Lake (approximately 100 km north of Vanderhoof). The project objectives for 1984 were to continue intensive training of Necoslie Band members in all aspects of the facility operation, including the rearing and release of 1983 brood Stuart River chinook, the habitat biophysical assessment of Sowecha Creek, the collection of 170,000 (84 brood) Stuart River chinook eggs and their subsequent incubation.

The rearing of the 1983 Stuart chinook was successfully completed with the final release on April 26, 1984, of 30,300 fry, of which 29,200 were coded-wired tagged. Through the summer the crew upgraded the facility by extending the building to provide an office and storage area and by fencing the grounds. Training was provided in stream biophysical inventory techniques which resulted in the assessment of Sowecha Creek and a final report documenting the importance and potential of the stream to salmonids. The project successfully met its target of 170,000 Stuart River chinook eggs, utilizing the asssistance of a job creation crew operating under contract. Survival of these eggs has been far better than in the past with approximately 90 percent now ponded.

The 1984 brood chinook,100,000 of which will be code-wire tagged, will be reared to approximately 6 g for release in late April 1985. Egg-take target for the project is again set at the facility capacity of 170,000.

Contact: Colin Masson, Project
Coordinator, Special Projects
Division.

Chilcotin River Reconnaissance

Three primary sites were identified in 1981 as having enhancement potential: a groundwater spring on the right bank of the Taseko River approximately 8 km upstream of the Taseko-Chilko confluence; groundwater seepages at the confluence of the Chilko and Little Chilcotin Rivers; and an artesian well at the Puntzi Mountain airbase on the Chilanko River.

The results of 1981-84 water quality and temperature monitoring at these sites were summarized in a report in 1984.

Other secondary sites (including Withrow Creek, Elkin Creek, and Chilko River near Chilko Lake) were also examined during monitoring trips, and during a bioengineering aerial survey done in September 1984. The three primary sites all have considerable potential, but offer different advantages; choice of one site will have to await direction from Field Service staff as to species and stock enhancement requirements for the area.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielson Senior Project Engineer, Engineering.

Pitt River Watershed Data

The Pitt River watershed has been the subject of a number of studies by various agencies and groups over the years. In order to consolidate the information relevant to salmonids and to better define potential enhancement opportunities and data gaps on this system, Northern Natural Resource Services Ltd. has undertaken a review of the available biophysical data. This report should be available by mid-1985.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

South Thompson Reconnaissance/Feasibility

In support of the pilot facilities being built at Spius Creek and on the middle Shuswap River, the following studies were undertaken or completed in 1984:

- a report on 1983 rearing capacity studies of the Middle Shuswap River and its main tributaries above and below Wilsey Dam was completed in 1984 by Alpha Bioresources Consultants

- a summary report on water quality sampling and temperature monitoring of the Wilsey Dam reservoir was prepared

- juvenile migration studies were undertaken in 1984 by Envirocon Ltd. on the Middle Shuswap River

- juvenile migration studies were undertaked by W.R. Olmsted and Associates, Inc. on the Nicola, Spius, and Coldwater systems.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Spius Creek Hatchery

Spius Creek pilot hatchery is located on Spius Creek near its confluence with the Nicola River, approximately 18 km downstream from Merritt. This facility, funded as part of a federal employment initiative, commenced operation in fall 1984. Along with Clearwater, Eagle and Shuswap hatcheries, Spius hatchery was designed to allow for assessment of the potential for chinook and coho production in the Thompson River watershed area. Some of the experimental work planned includes:

- size and time-at-release studies
- rearing and release strategy studies,
- hatchery vs. wild interactions
- homing/imprinting studies.

In 1984, 225,000 Nicola chinook eggs, 65,000 Coldwater chinook eggs and 75,000 Coldwater coho eggs were collected and incubated at the newly constructed groundwater-fed hatchery. This pilot facility will be expended in summer 1985 with the addition of a gravity-feed water supply, extended rearing channels, covered storage, and a waste water settling lagoon. The hatchery is currently operated under contract by Diversified Ova-Tech.

Contact: Colin MacKinnon, Head,
Fraser River/NBC/Yukon Unit,
Enhancement Operations.

Clearwater Hatchery

Clearwater pilot hatchery is located within the village of Clearwater, upstream of the confluence of the Clearwater and North Thompson rivers. This facility, funded as part of a federal employment initiative, commenced operation in fall 1984. Along with Eagle, Spius, and Shuswap hatcheries, Clearwater hatchery was designed to allow for assessment of the potential for chinook and coho production in the North Thompson watershed area. Some of the experimental work planned includes:

- size and time-at-release studies
- rearing and release strategy studies
- hatchery vs. wild interactions
- homing/imprinting studies

In 1984, 500,000 Clearwater chinook eggs, 150,000 Raft River chinook eggs and 135,000 Lion Creek coho eggs were collected and incubated at the newly constructed groundwater-fed hatchery. This pilot facility will be expanded in summer 1985 with the addition of rearing channels, a new well, an aeration tower and covered storage. The hatchery is currently operated under contract by Envirocon Ltd.

Contact: Colin N. MacKinnon, Head,
Fraser River/NBC/Yukon
Enhancement Operations.

Shuswap Hatchery

Shuswap River pilot hatchery is located immediately downstream of Shuswap Falls, 12 km northeast of Lumby. This facility, funded as part of a federal employment initiative, commenced operation in fall 1984. Along with Clearwater, Eagle, and Spius hatcheries, Shuswap hatchery was designed to allow for assessment of the potential for chinook and coho production in the South Thompson watershed area. Some of the experimental work planned includes:

- size and time at release studies
- rearing and release strategy studies
- hatchery vs wild interactions
- homing/imprinting studies

In 1984, 116,000 Shuswap chinook eggs were collected and incubated at the temporary groundwater-fed pilot hatchery. A new expanded pilot facility will be built at a nearby site in summer 1985. The new expanded pilot facility will have an incubation capacity of one million eggs. The temporary pilot hatchery is currently operated under contract by Envirocon Ltd.

Contact: Colin McKinnon, Head, Fraser
River/NBC/Yukon Unit,
Enhancement Operations.

Habitat Improvement Projects

Eleven habitat improvement projects have been carried out within the Fraser system since 1978. They have ranged from placing graded gravel at the outlet of Chilliwack Lake to rehabilitating 7,500 m^2 of unused groundwater slough on the Harrison River. Most of the work has been to improve spawning habitat for chum salmon but use by coho, at most sites, has been high. Returns of channel-produced fish are now occurring at a number of sites with perhaps the best results being realized at Worth Creek. This site was developed in 1979. At that time, very few salmon (< 25 fish) made use of this groundwater spawning area. Since 1982, up to 5,000 chum and 300 coho salmon have returned and spawned in the improved channel. Considering the small size of this development (840 m^2), this indeed is an unexpectedly high return.

Two sites were improved during 1984. A groundwater channel was built at the extreme upper end of Chilqua Creek which flows into Hatzic Lake near Mission. The channel (1000 m^2) is expected to produce a minimum of 500,000 fry which should return 5,000-7,000 chum salmon annually.

Maria Slough is a large cutoff flood channel of the Fraser River near Agassiz. The upper end of a blind slough was extended to provide an additional 2,500 m^2 of spawning area. It was used by approximately 500 chum, 50 sockeye and 25 coho in fall 1984. It is hoped that these escapements will rise by an order of magnitude within one or two cycles.

Habitat improvement projects suggested for 1985 include:

- upgrading of Peach Creek spawning channel primarily for use by spawning coho and chum salmon (Chilliwack-Vedder system)

- upgrading of coho spawning areas on Hicks Creek (near Agassiz)

- improvements to groundwater channel on Chehalis Flats in Area 1A in conjunction with highway redevelopment (Chehalis-Harrison River)

- improvement of groundwater spawning habitat for coho salmon in the Deadman River System (Thompson River)

- Creation of self-maintaining spawning area in Nicomen Slough (Mission). This will be a pilot project aimed at evaluating a new concept in spawning area development.

Contact: Matthew Foy, Biologist, Small
Projects Unit, Special
Projects Division.

Provincial Status Report

Activities associated with the management of steelhead and anadromous cutthroat trout centered mainly around enhancement, angler surveys and biophysical stream assessments. After years of decline in numbers of cutthroat and steelhead, stocks of these fish are improving, thanks to very conservative harvest regulations and an aggressive hatchery program, which emphasizes the importance of wild native stocks of fish. Nine hatchery facilities (federal, provincial, public involvement) now supply steelhead and cutthroat smolts and fry to about twenty-four streams and sloughs in the region. Angler use on important steelhead and cutthroat waters is increasing, especially on streams that contain hatchery fish.

Lower Fraser River

The enhanced steelhead run on the Alouette River, continues to support an increasing angler use and catch. The rate of increase (comparing 1983/84 to previous years) appears to be slowing down. Vedder River enhancement using a winter steelhead smolt and fry stocking program and wild steelhead release regulations has captured considerable angler interest. Angler use and steelhead catch has been increasing dramatically. In 1983/84, the Vedder ranked as the number one river in B.C. for angler use and steelhead catch. Steelhead production capability and carrying capacity studies continue on the Vedder and the results of this work will influence the direction of the fry component of the hatchery program.

The Chehalis River hatchery program for steelhead and anadromous cutthroat is continuing successfully, although availability of cutthroat and upper Harrison Lake steelhead brood stock remains a problem. The first stocking of steelhead and cutthroat smolts was done in spring of 1984. Adult returns will start in 1986.

Summer-run steelhead management continues actively on Coquihalla River, and Silverhope Creek. On Coquihalla River, juvenile steelhead assessment work continued and the results are used to modify enhancement techniques. For example, smolt stocking is being phased down in favor of planting summer steelhead fry and parr.

This change reflects what has been learned about habitat capability in the system. Many years of detailed juvenile assessment work on the system is providing a baseline of data from which to assess impacts from Coquihalla Highway construction and problems like the Carolin Mines cyanide spill. Silverhope River creel census and brood capture operation provides an insight into the success of hatchery summer steelhead fry stocking. Returns of marked adults during the 1984 special fishery season was about 15 percent of the total catch. This was less than predicted.

Cutthroat hatchery programs in the Mud Bay and Fraser River areas continue to bolster the supply of these fish for anglers. Contract angler surveys in both these areas report a high contribution of hatchery cutthroat in angler catches.

Contact: Peter Caverhill, Regional
Fisheries Biologist,
Fisheries Branch, Surrey.

Steelhead Brood Collection and Fry Stocking: Bonaparte-Deadman

Bonaparte River flows through Cache Creek and meets the Thompson River at Ashcroft. Deadman River meets the Thompson five km downstream of Savona.

The Bonaparte River has been the location of steelhead fry and smolt stocking since 1979. Bonaparte River fry stocking includes 18,000 in 1979, 39,000 in 1981, 38,000 in 1982 and 51,000 in 1983. Annual smolt releases are 40,000. Returns are expected to provide increased angling opportunity for the Thompson. The Bonaparte River has an impassable barrier two km from its confluence. Fry stocking has been above the falls and it is hoped that providing transport past the falls for returning steelhead would be a priority project in the near future. Bonaparte River brood stock is collected from the Deadman River. Deadman River was stocked in 1980 with 37,000 fall fry.

Brood stock in 1984 was collected entirely from the Deadman River. The Deadman fence is a permanent structure located 11 km upstream of the Thompson. A total of 30 females and 7 males were transported to Loon Creek hatchery. The Deadman River brood fence was operated by consultants in 1984 to study the ecological characteristics of Deadman River steelhead.

A total of 280,000 fry were stocked in the headwaters of the Bonaparte River. Fry were scatter-released from Rayfield River to Cache Creek.

Steelhead immigration through a brood stock collection fence began on April 20, peaked May 19 and was complete by June 3. A total of 291 steelhead were captured by the fence. Of these, 21 were of hatchery origin. A total of 82 males and 172 females spawned upstream of the counting fence. The dominant age of wild steelhead was 2.2+. An incidence of 7 percent repeat spawners was found, and all were female. Deadman River hatchery returns were predominantly 2.1+. Bonaparte River strays were 2.2+. Spawner distribution, abundance and numbers of redds constructed were determined upstream of the counting fence. Physical characteristics of redds were noted. A total of 318 redds were dug; redd/female ratios were variable. Redd/spawner ratios obtained in preferred spawning habitat significantly overestimated numbers of spawners when extrapolated to the entire river. Spawner turnover rate was five days. Potential egg deposition was estimated at 1,700,820. Spawner emigration began May 21 and continued unmonitored into June.

Emergence and emigration of steelhead fry was monitored from July through September by floating inclined plane traps. Steelhead emergence probably began in mid to late June, and was complete by early August. Emergent fry averaged 24.5 mm and 0.05 g. By late September, fry averaged 58.7 mm and 2.1 g. Peak emigration occurred during the last week of August.

Standing stock assessment was conducted in August and September upstream of the migration index traps. Standing stocks were 148,117 and 54,302, respectively. An estimated 94,376 fry emigrated past the inclined plane traps by September 21. Total fry produced upstream of the traps was estimated at 169,169. Egg to post-emergent fry survival was estimated at 10.0% (range: 8.0 - 12.0 percent). Instream fry mortality was approximately 14.6 percent of standing stock per month.

Thompson River Creel Census

Thompson River flows from Savona through Ashcroft and Spences Bridge before it joins the Fraser at Lytton.

The Thompson River creel census has been in operation since 1976 providing information to aid in the management of Thompson steelhead. The creel census is also used to monitor adipose and maxillary clipped steelhead returns.

An estimated 1,560 anglers fished 10,490 angling days and caught 4,154 steelhead in 1984. Catch per angler day in 1984 was 0.40. Anglers released 70.0 percent and killed 30.0 percent of their catch.

British Columbia anglers, including locals accounted for 89 percent of the season angling effort and 80 percent of the reported catch. Anglers from Washington and Oregon had the highest release rate of 57 percent while Canadian non-B.C. residents reported the highest kill rate at 75 percent.

Creel census personnel reported 34 marked steelhead in 1984. Fifteen maxillary clips were identified as returns from fry stocking in the Bonaparte and Deadman Rivers. Nose tags were found in 8 of the 9 adipose-clipped fish and again were of Deadman and Bonaparte origin. An additional ten adipose-clipped fish were released.

Deadman River Bank Stabilization and Revegetation

Deadman River flows into the Thompson River approximately 5 km downstream of Savona.

The land along Deadman River was defoliated early in this century to grow alfalfa and provide pasture land for hundreds of cattle. Ranchers in the valley winter cattle along the Deadman River and move cattle to summer grazing ranges in early June. Steelhead spawn in the Deadman River during May while cattle are still wintering in the valley. Unfortunately, cattle move back and forth across the Deadman River, disturbing spawning steelhead and trampling redds.

In order to stabilize stream banks and protect new vegetation growth from cattle grazing, riprap, tree planting and fencing was planned.

Red osier dogwood is the predominant plant species in stable stream areas. It provides good cover and stability as it overhangs the stream areas. Seeds were collected in the fall from red osier dogwood, Douglas maple, chokecherry and wild rose and germinated at a coastal nursery.

Two kilometres of key spawning habitat located on the Docksteader property was stabilized by placing riprap in several eroded areas. Rock groins and cabled logs were added to provide cover for rearing fish. Fencing and tree planting is planned for the summer of 1985.

Steelhead Brood Stock Collection and Fry Stocking - Spius Creek - Coldwater River

Spius Creek flows into the Nicola River downstream of Merritt and the Coldwater River enters the Nicola immediately downstream of Merritt.

Spius Creek was identified as an area generally undercolonized by juvenile salmonids. Although access is available to most of Spius Creek and its major tributary, Maka Creek, spawner escapement has been minimal in headwater areas. Spius and Maka Creeks have therefore received fry stocking since 1982. Fry stocking has increased from 38,000 in 1982, to 82,000 in 1983.

Fifteen steelhead, 12 females and 3 males, were angled from Spius Creek and transported to Loon Creek hatchery in 1984.

A total of 111,000 fry were stocked into Spius and Maka Creeks and 52,000 into the Coldwater River. Releases were done in early August by truck and helicopter to densities of 0.4 fry/m^2.

Contact: Ian McGregor, Biologist,
Fisheries Branch, Kamloops.

Chilcotin River Steelhead Fry Stocking

Steelhead returning to the Chilcotin River system have declined severely during the last 10 - 15 years. Mixed catch commercial net fisheries, Fraser River Indian net fisheries and interception by Fraser River bar anglers appear to continue as limiting factors. A previous factor was excessive kill by anglers on the Chilcotin system. Very restrictive angling regulations are presently controlling the latter problem.

Starting with pilot projects in 1981 and 1982, steelhead fry were raised at a makeshift hatchery facility at Hanceville. In 1983, 87,500 fry were raised in the same crude facility. It became apparent that successful fry rearing could not be reasonably certain without improvements to the facility.

Following purchase of the hatchery site and securement of the water source by the Ministry of Environment in 1983, it became feasible to construct a suitable hatchery facility. This was done, principally by SEP staff, during February and March 1984.

The fry stocking program was continued in 1984 with the stated goal of rearing 100,000+ fry for release to the Little Chilcotin River. As in previous years, broodstock collection and holding, spawning, incubation, rearing and release were done in the period April - July inclusive by SEP staff and one contract technician who assumed his duties during the rearing stage.

A total of 151,164 eggs were taken from 18 female steelhead. Approximately 124,110 fry (.41 g average weight) were released into the Little Chilcotin River in late July. Of these, 80,119 fry were spray-dye marked for assessment purposes. Release reaches were increased in 1984 (over 1983) to five from three and to 38 km from 24 km. Survival from egg to released fry was 82.1 percent.

Aerial counts of adult steelhead in the Chilko River were done on May 14 and May 18 with counts of 144 and 236 respectively. An escapement of 1,140 adults is theoretically possible.

Assessment of fry released to the Little Chilcotin and wild fry densities in the Chilko were done during mid-September. A separate report is pending.

The fall creel census indicates 160 angler days were expended which resulted in 50 steelhead being caught; 28 (56 percent) of these were released. However, as of January 16, 1985 only 29.4 percent of anglers contacted have replied to the census.

Work to be done in 1985 includes:

- 100,000 2-g fry to be released
- 20,000 unfed fry to be released
- if ice leaves the river relatively early, a mark/recapture (swim) program to assess adult populations is planned (marking started in fall of 1984)
- aerial count of adults on the Chilko spawning beds will be continued
- fall creel census will continue along with parr density assessment on the Chilcotin and fry-release assessment on the Little Chilcotin and wild fry assessment on the Chilko.

Contact: Dennis Wilders, Tom
Wilkinson, Fisheries Branch.

Chilliwack River Steelhead Evaluations

Returns of various groups of hatchery steelhead to the Chilliwack River have been examined for several years by staff at the Abbotsford Research Hatchery. Evaluations of coded-wire tag recoveries was continued in 1984. A creel census was also initiated to ensure a greater return of tags from a large group of adults expected to return from the 1982 smolt releases. These smolts had been released in large, equal numbers at four locations throughout the river. An analysis of the location of capture of each tag group was required to show the most effective stocking location and the incidence of straying upstream from the stocking site.

Smolt groups were released at Vedder Crossing, Tamahi Creek, Slesse Creek and Foley Creek. Respective percent incidence in the sport fishery was 31 percent, 27 percent, 22 percent and 21 percent. Straying of groups was high. For example, 23 percent of the Vedder Crossing release was caught 10-20 km upstream from the release site. Preliminary results from 1984 to 1985 indicate that the lower river release group contributed more adults to the fishery. An additional benefit is that the impacts of residualized hatchery fish (i.e. failed to migrate to sea) on wild juveniles should be minimized by a strategy where all smolts are stocked in the lower 10 km of the river, 20 km downstream from the Chilliwack hatchery.

Further collection of coded-wire tags will be continued in 1985 to obtain results from the ocean age 3 group from the same releases of smolts.

Contact: Bob Land, Supervisor,
Abbotsford Research Hatchery;
Art Tautz, Manager; Pat
Slaney, Senior Research
Biologist, Fisheries Branch.

Sea-run Cutthroat Evaluations

The Semiahmoo Fish and Game Club, in cooperation with the Department of Fisheries and Oceans and Provincial Fisheries Branch, has operated a counting fence on the Little Campbell River since 1982. It monitors steelhead and cutthroat stock status in this low gradient fertile stream and evaluates migratory success of cutthroat smolt and fall fingerlings stocked in mainstem and tributaries respectively. Poor smolt yield and high residualism from large smolts (average weight 112 g) were indicated with initial attempts. Cutthroat adults through the fence remained very low.

Obtaining a cutthroat adult population estimate was not possible since the trap flooded out and was damaged for several days during the peak of downstream migration of smolts and adults in early May 1984. The Semiahmoo Fish and Game Club has not reported adult capture results to that date as yet, but numbers were again very low. Angler catch downstream of the fence appears to surpass the harvestable surplus.

The migration of smolts stocked above the fence in April (3,093 at an average weight of 98 g) was not successfully enumerated. Smolt number from the 1983 fingerling outplant to upstream tributaries was also not available. On September 24, 5,679 fingerlings (103/kg) were once again stocked in tributaries. The downstream fence was repaired and improved. Instream fish sampling in July 1984 indicated low wild cutthroat biomass in the mainstem (< 0.45 g/m^2) compared to steelhead parr (1.74 to 4.18 g/m^2) whereas hatchery cutthroat parr which residualized at release sites were higher in biomass (8.37 g/m^2). A release of 3,000 smolts at 65 g mean weight is planned for April 1985, and a creel survey will be incorporated into the program. Fry, fingerling and smolt stocking evaluations will continue to rely on the co-operation of the Semiahmoo Club, DFO and provincial contracts.

Contact: Bruce Ward, Fisheries
Biologist, Fisheries Branch.

Job Creation Projects

Mossom Creek

A crew was hired to upgrade the existing incubation facility on Mossom Creek operated by students at Centennial High School.

In addition to general site preparation, the crew built and installed four incubation boxes, doubling the facility's incubation capacity. They also installed four aluminum rearing troughs and built a storage shed.

Surrey-Abbotsford Streams

The Surrey Board area (the south side of the Fraser River between Douglas and Barnston Islands) was monitored for fish species present and water quality and the CNR twin-tracking work was also monitored.

The crew also:

- carried out a detailed biophysical inventory of Clayburn Creek
- conducted detailed spawning surveys of Coghlan, Nathon, Clayburn, Stoney and Willband Creeks
- restored stream habitat of Bear and Cougar Canyon Creeks
- collected data relating to pump stations and their effect on smolt migration
- salvaged fry in Norrish Creek and Nicomekl River.

Chilliwack Hatchery

A job creation crew at Chilliwack hatchery assisted in some construction and maintenance, sampled juvenile coho and steelhead and helped with general hatchery operations.

Eagle and Kingfisher Hatcheries

For the Eagle River major facility, the job creation crew collected chinook brood stock by angling.

For the volunteer hatchery run by the Kingfisher Community Club, the crew constructed a counting fence on Kingfisher Creek, helped capture brood stock and assisted with general hatchery improvements.

Dunn Lake

The job creation crew assisted the North Thompson Indian Band in several aspects of its project on Dunn Lake:

- a trap was constructed and installed and adult and juvenile coho were enumerated
- temporary fences were constructed to collect brood stock on Fennel, Lemieux and Dunn Creeks
- fry were released from the Dunn Lake rearing pens and then monitored
- two incubation boxes for Dunn Creek were built
- coho juveniles were captured, tagged and fin clipped
- egg-takes were conducted
- beaver dams were removed
- adults were tagged and carcasses recovered.

Stuart Pilot Hatchery

The job creation crew collected brood stock, conducted an egg-take, monitored water quality, built a fence and trough covers. The crew also conducted stream surveys of Dog and Sowchea Creeks.

Chilliwack Area

The job creation crew conducted a biophysical survey and rehabilitated habitat of a 2 km section of Little Chilliwack Creek. In addition, the crew removed barriers to salmon migration in Hopedale, Ryder, Lorenzetta and Salwein Creeks.

Chum and coho spawners were also enumerated in six local streams and a creel census was conducted at Hope-Camp Slough.

Fraser Chum Investigations

Project workers conducted daily counts of spawning chum salmon in the mainstem Fraser (between Hope and Vedder River mouth), and in North/South Alouette River and Blaney, Jones, Sucker Creeks. Near Mission, they set nets in the Fraser for sampling chum fry. Data from this project will help management biologists to assess chum escapements.

North Thompson Band Support

This project provided training, education, and hands-on experience in fish culture for several workers hired to assist the North Thompson Band with its CEDP. The crew cleared obstructions and installed a counting fence in Deadman Creek, constructed a workshop/storage shed, conducted egg-takes, measured temperature and oxygen in Snohoosh/Mowich Lakes and Deadman Creek, and counted spawning and holding coho in Deadman.

Harrison River

The Chehalis Band sponsored this project on the Harrison River. The crew captured chum brood stock and conducted egg-takes. Workers monitored water quality and flows at the Band's hatchery and in the five incubation pits and spawning channels. They also cleared trails for easier access to spawning channels.

Contact: Chris deHrussoczy-Wirth,
Head, Employment Development,
Special Projects Division.

Table 7

Public Participation Projects

FRASER RIVER PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Nicomekl R.	George Derkson	8	5	incubation, rearing	coho	5,800	97	71
Union Creek	Joe Hopink	12	5	incubation	coho	12,000	60	144
						High mortality due to siltation from land development upstream.		
Little Campbell R.	Semiahmoo Fish & Game Club	25	7	incubation, rearing, tagging, studies	coho	38,132	62	4,368
						Being reared for release in May 1985 are 25,304 juveniles.		
					chinook	10,441	38	313
						High mortality due to mechanical shock and low oxygen.		
					chum	2,469	88	20
Serpentine R.	K.B. Woodward Elementary School	150	4	incubation in school	coho	2,800	93	34
—	Kinvig Elementary School		1	incubation in school	coho	Vibration of refrigeration system caused 100% mortality. Problem will be corrected in time for 1984 brood eggs.		
Serpentine R./ Hyland Creek	Surrey Fish & Game Club	20	6	incubation, stream improvement	coho	11,000	61	132
Chilliwack River/ Frosst Creek	Center Creek Corrections Camp	20	4	incubation, rearing	coho	Pump failure killed 60,000 eggs. Malachiting error killed 15,000 eggs and 56,000 fry.		
					cutthroat	2,300	46	32

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Chilliwack Area Streams	Chilliwack Senior Secondary School	50	4	incubation in school	coho	5,000	33	60
Contact: Joe Kambeitz, SEP Community Advisor.								
Mossom Creek	Centennial High School	25	9	incubation	chum	60,000	75	480
						Eggs were from Weaver Creek spawning channel.		
Brunette River	Sapperton Rod & Gun Club	12	6	rearing, fry release, fishway, education	coho	30,000	—	3,900
						Released in Stoney Creek and Burnaby Lake. 20,000 fry being reared at Alouette hatchery for release in spring 1985.		
Kanaka Creek	Greater Vancouver Regional District/The Sun	20	3	incubation, rearing, information	steelhead	6,435	—	228
					chum	39,600	92	792
					coho	11,500	80	4,215
						Rearing 25,800 for release in April 1985.		
Silvermere Lake	Silverdale Elementary School	40	4	incubation, rearing	chum	38,000	95	304
						Released in Stave River.		
					coho	9,200	71	255
						Released in Silver Lake and tributaries and in Draper Creek.		
Sayers Creek	Stave Lake Correction Camp		1	fry release	chinook	39,132	—	1,174
						Released Chehalis hatchery fry in Stave River.		

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Coquitlam River	Port Coquitlam Rod & Gun Club		1	incubation, rearing	chum	12,000	48	96
						High mortality due to siltation and fungus.		
					coho	8,000	34	765
						Rearing 4,000 fry for release in spring 1985.		
					steelhead	4,000	80	-
Contact: Gary Taccogna, SEP Community Advisor.								
Duteau Creek	Lumby and District Wildlife Association	30	5	incubation	coho	13,000	54	195
Shuswap River/ Kingfisher Creek	Kingfisher Community Club	25	4	incubation	chinook coho	27,000 3,000	90 94	130 45
Louis Creek	Fine Fish in Natural Setting	14	3	incubation	coho	25,500	85	383
Barriere River	David Smith	3	3	incubation	coho	900	90	11
Cook Creek	Blue River Lioness Club	—	6	incubation	coho	5,500	92	66
Lemieux Creek	John Todd Elementary School	10	5	incubation	coho	10,500	95	158
Yalakom River	Lillooet Secondary School	50	6	incubation	coho	14,000	93	168
Chilako River	Hutda Lake Corrections Camp	85	4	incubation	chinook	14,000	56	67
						Released in Slim Creek.		

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Salmon River	Spruce City Wildlife Association	100	7	incubation	chinook	400	3	12
						High temperatures and poor water quality resulted in high mortalities.		
Shuswap River	Armstrong Elementary School	30	1	classroom incubation	sockeye	3,000	25	30
Louis Creek	Bingham Elementary School	30	1	classroom incubation	coho	49	25	1

Contact: Dennis Demontier, SEP Community Advisor.

Lemieux Creek	Clearwater Secondary School	30	1	classroom incubation	coho	30	15	0
Bridge River	Lillooet Rod & Gun Club	10	1	incubation	coho	13,500	90	162
Bridge River	Lytton Elementary School	30	1	classroom incubation	coho	200	89	2

Contact: Dennis Demontier, SEP Community Advisor.

Table 8

Fraser River SEP Facilities: Juvenile Releases 1984*

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Inch Creek Hatchery						
Coho	1982	Inch	175,030	39	74	17.0
Chum	1983	Inch	2,291,171	38	92	0.8
Chum	1983	Blaney	595,850	0	82	1.2
Chum	1983	Stave	3,445,880	0	79	1.2
Cutthroat	1983	Inch	23,654	100	N/A	48.1
Alouette River Hatchery						
Not available at time of printing.						
Fraser Valley Trout Hatchery						
Steelhead	1983	L. Campbell	10,000[1]	100	N/A[2]	91.0
Steelhead	1983	Mud Bay	16,297	0	N/A[2]	88.0
Steelhead	1983	Marshall	3,973	72	N/A[2]	105.0
Steelhead	1983	Coquihalla	31,323	100	N/A[2]	60.0
Steelhead	1984	Murray	11,120	0	N/A[3]	0.5
Steelhead	1984	Coquihalla	73,452	0	97	0.9
Steelhead	1984	Kanaka	13,578[4]	0	96	1.7
Steelhead	1984	Alouette	40,655[5]	85	88	7.0
Steelhead	1984	Coquihalla	105,552	15	N/A[3]	1.5
Steelhead	1984	Silverhope	35,000	100	86	1.1
Steelhead	1984	Squamish	53,460	0	95	1.8
Steelhead	1984	Morice	61,700	0	60	1.8
Steelhead	1984	Suskwa	50,350	0	85	2.4
Cutthroat	1983	Fraser	3,524[6]	100	N/A[2]	77.0
Cutthroat	1983	Mud Bay	25,671[7]	100	N/A[2]	94.0
Cutthroat	1984	Kanaka	6,750[8]	0	92	1.4
Cutthroat	1984	Fraser	11,896	0	68	1.1
Cutthroat	1984	Fraser	91,492[9]	0	N/A[3]	1.6
Alouette River Correctional Centre						
Steelhead	1983	Alouette	28,478[10]	100	N/A	76.0
Boulder Bay Net Pens						
Steelhead	1983	Alouette	3,000[11]	0	N/A	73.5
Chilliwack River Hatchery						
Chinook	1983	Harrison	1,027,914	7	70	6.1
Coho	1982	Chilliwack	544,679	24	72	17.5
Steelhead	1984	Chilliwack	118,900	0	N/A	1.7
Steelhead	1983	Chilliwack	125,684	97	83	83.3
Chum	1983	Chilliwack	1,175,260	14	68	1.1
Side Channel Projects						
Chum	1983	Hopedale Sl.	150,000	--	--	--
Coho	1983	Hopedale Sl.	50,000	--	--	--
Chum	1983	Ryder Cr.	150,000	--	--	--
Chum	1983	Reach Cr.	100,000	--	--	--
Chum	1983	Railroad Cr.	400,000	--	--	--
Chum	1983	Worth Cr.	400,000	--	--	--
Coho	1983	Worth Cr.	50,000	--	--	--
Chum	1983	L. Mountain Sl.	1,500,000	--	--	--
Chum	1983	Billy Harris	1,500,000	--	--	--

Table 8 (Cont'd)

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Chehalis River Hatchery						
Chinook	1983	Harrison	1,641,491	12	55	3.6
Coho	1982	various	389,205	19	67	16.1
Steelhead	1983	various	82,730	92	78	70.9
Chum	1983	Chehalis	2,818,371	2	89	0.9
Chum	1983	Squakum	681,134	9	91	1.0
Chum	1983	Harrison	9,615,977	0	88	1.0
Chum	1983	Weaver	514,503	0	95	1.1
Chehalis Band Project						
Not available at time of printing.						
Birkenhead River Hatchery						
Chinook	1983	Birkenhead	196,922	42	N/A	3.1
Jones Creek Spawning Channel						
Pink	1983	Jones	166,500	0	N/A	N/A
Chum	1983	Jones	69,750	0	N/A	N/A
Eagle River Hatchery						
Chinook	1983	Eagle	103,455	58	81	2.8
Coho	1983	Eagle	448,203	23	88	2.1
Coho	1983	Salmon	190,124	28	90	2.2
Loon Creek Hatchery						
Chinook	1983	Bonaparte	34,360	86	68	3.0
Chinook	1983	Deadman	32,620	81	72	2.4
North Thompson Band Project						
Not available at time of printing.						
Quesnel River Hatchery						
Chinook	1983	Nazko	161,647	29	90	6.5
Chinook	1983	Quesnel	711,867	24	91	5.1
Chinook	1983	Bowron	435,242	11	88	6.2
Chinook	1983	Indianpoint	86,329	60	92	5.3
Chinook	1983	Cariboo	83,846	59	85	6.5
Chinook	1983	Horsefly	23,168	91	96	6.0
Chinook	1983	McKinley	17,974	82	78	1.9
Stuart River/Necoslie Band Project						
Not available at time of printing.						

* Includes facilities constructed prior to SEP.

N/A means "not available."

[1] Half were released in Little Campbell and half in Nicomekl River.

[2] Survival figure not available as portion of brood year was released in 1983.

[3] Survival figure not available as portion of brood year is being held for release in 1985.

[4] 7,820 of these were transferred to Bell-Irving hatchery for further rearing.

[5] 34,665 of these were transferred to Alouette River Correctional Centre for further rearing.

[6] Released into Marshall Creek.

[7] Released into L. Campbell, Serpentine, Murray, and Nicomekl Rivers.

[8] Transferred to Bell-Irving hatchery for further rearing.

[9] 39,382 of these were transferred to Alouette River Correctional Centre, and 31,900 transferred to Inch Creek hatchery for further rearing.

[10] Released into South Alouette River.

[11] Released into Brunette River.

Table 9

Fraser River SEP Facilities: Status at December 1984*

					Expected Release		
Species	**Stock**	**Brood**	**Stage**	**No. on Hand**	**Date**	**Number**	**Site**
Inch Creek Hatchery							
Not available at time of printing.							
Alouette River Hatchery							
Not available at time of printing.							
Chilliwack River Hatchery							
Coho	Chilliwack	83	juvenile	2,200,000	May 1985	2,100,000	hatchery
Chinook	Harrison	84	alevin	1,100,000	June 1985	1,050,000	hatchery
Chum	Chilliwack	84	alevin	4,000,000	April 1985	3,400,000	hatchery
Steelhead	Chilliwack	84	juvenile	106,000	May 1985	105,000	Chilliwack R.
Coho	Chilliwack	84	egg/alevin	2,100,000	May 1986	2,000,000	Chilliwack R.
Coho	Post Cr.	84	egg/alevin	500,000	April 1985	450,000	Slesse Cr.
Coho	Dolly Varden	84	egg/alevin	200,000	May 1986	150,000	Dolly Varden Cr.
Fraser Valley Trout Hatchery							
Steelhead	Coquihalla	84	presmolt	17,000	May 1985	17,000	Coquihalla
Steelhead	Mud Bay	84	presmolt	10,800	May 1985	10,800	Nicomekl
Cutthroat	Mud Bay	84	presmolt	33,000	May 1985	33,000	Nicomekl L. Campbell
Cutthroat	Fraser	84	presmolt	7,600	May 1985	7,600	Marshall
Alouette River Correctional Centre							
Steelhead	Alouette	84	presmolt	34,000	May 1985	34,000	Alouette Brunette
Cutthroat	Fraser	84	presmolt	38,300	May 1985	38,300	Alouette Harrison Hope/Camp De Boville
Chehalis Band Project							
Chum	Harrison	84	egg	500,000	N/A	N/A	N/A
Chehalis River Hatchery							
Chum	Chehalis	84	egg	2,231,000	Mar.-June '85	2,000,000	Chehalis
Chum	Squakum Cr.	84	egg	3,774,000	Apr.-May '85	1,100,000	Squakum
					Apr.-May '85	2,400,000	Chehalis
Chum	Harrison R.	84	egg	8,360,000	May-June '85	7,000,000	Harrison
					May-June '85	1,000,000	Chehalis
Chinook	Harrison R.	84	egg	3,000,000	June 1985	300,000	Chehalis

Table 9 (Cont'd)

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Chehalis River Hatchery Cont'd							
Coho	Weaver Cr.	84	egg	234,800	May 1986	130,000	Weaver
Coho	Chehalis R.	84	egg	583,440	May 1986	470,000	Chehalis
Coho	Harrison	84	egg	53,400	May 1986	40,000	Harrison
Coho	Coho Cr.	84	egg	41,047	May 1986	33,000	Coho
Coho	Hicks/Maria	84	egg	45,200	May 1986	36,000	Hicks/Maria
Coho	Trout Cr.	84	egg	6,820	May 1986	4,000	Trout
Coho	Harrison R.	83	fry	15,234	May 1985	15,000	Harrison
Coho	Weaver Cr	83	fry	248,324	May 1985	130,000	Weaver
					May 1985	115,324	Chehalis
Coho	Chehalis R.	83	fry	283,840	May 1985	280,000	Chehalis
Coho	Evans Cr.	83	fry	17,441	May 1985	17,000	Evans
Coho	Coho Cr.	83	fry	55,141	May 1985	54,500	Coho
Coho	Squakum Cr.	83	fry	2,638	May 1985	2,600	Squakum
Steelhead	Weaver Cr.	84	fry	21,439	May 1985	21,000	Weaver
Steelhead	Chehalis R.	84	fry	59,700	May 1985	59,000	Chehalis
Steelhead	Upper Harrison	84	fry	5,600	May 1985	5,500	Big Silver
Cutthroat	Harrison watershed	84	fry	3,542	May 1985	3,500	Harrison
Birkenhead River Hatchery							
Coho	Birkenhead	83	fry	27,700	May 1985	27,600	Birkenhead
Coho	Birkenhead	84	egg	39,220	May 1986	39,000	Birkenhead
Jones Creek Spawning Channel							
No pink salmon escapement in even years.							
Eagle River Hatchery							
Chinook	Eagle	84	alevin	550,000	April 1985	485,000	Eagle
Chinook	Salmon	84	alevin	400,000	April 1985	350,000	Salmon
Coho	Eagle	84	alevin	1,000,000	May 1985	880,000	Eagle
Coho	Salmon	84	alevin	600,000	May 1985	530,000	Salmon
Loon Creek Hatchery							
Steelhead	Deadman	84	presmolt	42,175	April 1985	41,700	Bonaparte
Chinook	Bonaparte	84	alevin	47,610	April 1985	46,000	Bonaparte
Chinook	Deadman	84	alevin	79,760	April 1985	78,000	Bonaparte
North Thompson Band Project							
Coho	Dunn Cr.	84	egg	N/A	Aug. 1985	55,000	Dunn
Coho	Lemieux	84	egg	N/A	Aug. 1985	50,000	Lemieux
Coho	Fennell Cr.	84	egg	N/A	Aug.- Sept. '85	50,000	Fennell

Table 9 (Cont'd)

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Quesnel River Hatchery							
Chinook	Quesnel	84	fry	445,000	Apr.-May '85	440,000	Quesnel
Chinook	Cariboo	84	fry	204,000	Mar.-May '85	202,000	Cariboo, Cunningham, Little
Chinook	Horsefly	84	fry	46,000	April 1985	45,000	Horsefly, McKinley
Chinook	Bowron	84	fry	401,000	April 1985	400,000	Bowron
Chinook	Indianpoint	84	fry	140,000	April 1985	139,000	Indianpoint
Chinook	Blackwater	84	fry	283,000	April 1985	281,000	Blackwater
Chinook	Nazko	84	fry	41,000	April 1985	40,000	Nazko
Chinook	Baezaeko	84	fry	124,000	April 1985	123,000	Baezaeko
Chinook	Willow	84	fry	100,000	April 1985	99,000	Willow
Chinook	Cottonwood	84	fry	98,000	April 1985	97,000	Swift
Chinook	James	84	fry	99,000	April 1985	98,000	James
Chinook	Fontoniko	84	fry	141,000	April 1985	140,000	Fontoniko
Chinook	Seebach	84	fry	146,000	April 1985	145,000	Seebach
Penny Pilot Hatchery							
Chinook	James Cr.	84	egg	185,000	July 1985	182,000	James
Spius Creek Hatchery							
Chinook	Coldwater	84	egg	65,000	Apr.-May '85	50,000	Coldwater
Chinook	Nicola	84	egg	225,000	Apr.-May '85	200,000	Nicola
Coho	Coldwater	84	egg	75,000	June 1985	65,000	Coldwater
Clearwater River Hatchery							
Chinook	Clearwater	84	egg	511,000	May 1985	480,000	Clearwater
Chinook	Raft	84	egg	155,000	May 1985	130,000	Raft
Coho	Lion	84	egg	135,000	June 1985	120,000	Lion
Shuswap River Hatchery							
Chinook	Shuswap	84	egg	112,000	May 1985	100,000	Shuswap
Stuart River/Necoslie Band Project							
Chinook	Stuart River	84	fry	170,000+	Apr.-May '85	170,000+	Stuart

* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 10

Fraser River SEP Facilities*: Surplus Sales 1984

Species	Number Eggs/Juv.	Stage	Dis-position	Value ($)	Surplus Adult Sales (kg)	Value ($)
Inch Creek Hatchery						
Chum	--	--	--	--	1,508.22	452.47
Mixed[1]	--	--	--	--	7,393.56	369.68
Chilliwack River Hatchery						
Chinook	8,000	fry	research	--	103.00	61.80
Coho	102,000	eggs	research	--	4,958.10	4,796.78
Coho	31,000	eggs	research	--		
Chum	50,000	eggs	research	--	1,819.00	545.70
Chehalis River Hatchery						
Chinook	121,000	eggs	research	--	--	--
Mixed[2]	--	--	--	--	9,228.00	276.84

* Includes facilities constructed prior to SEP.

[1] Chum and coho sold together.
[2] Chinook and coho sold together.

Table 11

Fraser River SEP Facilities*: Escapement to Facility 1984

Species	Escapement to Facility	Spawned for Hatchery Stock male	Spawned for Hatchery Stock female	% Marked (male and female)
Inch Creek Hatchery				
Not available at time of printing.				
Fraser Valley Trout Hatchery				
There are no escapements to the hatchery since stocks are outplanted to sites away from the rearing facilities.				
Chilliwack River Hatchery				
Coho (jack)	3,180	0	0	20
Coho (adult)	5,500	1,169	1,216	47
Chum	5,463	359	287	4
Chinook (jack)	332	0	0	9
Chinook (adult)	204	49	68	19
Steelhead	189	5	5	79
Chehalis River Hatchery				
Chinook (jack)	24	0	0	21
Coho (jack)	1,253	0	0	6

Table 11 (Cont'd)

Species	Escapement to Facility	Spawned for Hatchery Stock male	Spawned for Hatchery Stock female	% Marked (male and female)
Birkenhead River Hatchery				
Chinook	--	21	25	4
Coho	--	18	16	--
Jones Creek Spawning Channel				
No pink salmon escapement in even years.				
Eagle River Hatchery				
Chinook (Eagle R.)	571	N/A	N/A	N/A
Chinook (Salmon R.)	625	N/A	N/A	N/A
Coho (Eagle R.)	7,000	N/A	N/A	N/A
Coho (Salmon R.)	1,728	N/A	N/A	N/A
Loon Creek Hatchery				
Chinook (Bonaparte)	--	23	24	N/A
Chinook (Deadman)	--	15	28	N/A
Steelhead (Deadman)	--	7	29	N/A
Steelhead (Nicola)	--	6	19	N/A

* Includes facilities constructed prior to SEP.
N/A means "not available."

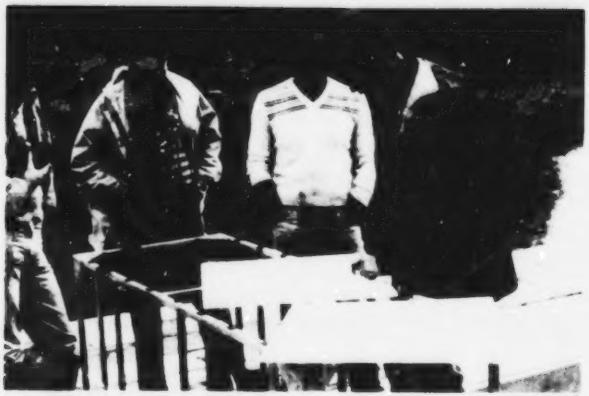
Table 12

Fraser River SEP Facilities*: Adult Production

		Expected Production from 1984 Releases		At Full Production		
Species	Total Adult Production	Years of Return	Contribution to Fisheries (pieces)	Total Adult (pieces)	Contribution to Fisheries (pieces)	Contribution to Fisheries (lbs)
Inch Creek Hatchery						
Coho	26,255	1984-85	15,385	43,100	25,213	126,100
Chum	126,658	1986-88	55,064	115,200	50,066	597,616
Cutthroat	2,365	1986-87	1,608	4,000	2,680	1,340
Fraser Valley Trout Hatchery						
Steelhead	4,918	—	2,458	—	—	—
Alouette River Correctional Centre						
Steelhead	1,139	—	569	—	—	—
Boulder Bay Net Pens						
Steelhead	120	—	60	—	—	—
Chilliwack River Hatchery						
Chinook	30,837	1985-88	25,219	43,200	35,372	298,933
Coho	81,702	1984-85	47,794	320,000	187,200	936,240
Steelhead	6,216	1986-91	3,720	5,200	3,120	32,136
Chum	23,505	1986-88	10,213	60,000	26,076	311,258
Chehalis River Hatchery						
Chinook	49,245	1985-88	40,285	54,000	44,215	373,666
Coho	58,381	1984-85	34,164	75,000	43,875	219,431
Steelhead	3,309	1986-90	1,980	5,400	3,240	33,372
Chum	272,599	1986-88	118,472	201,600	87,615	1,045,828
Birkenhead River Hatchery						
Chinook	1,477	1986-88	1,228	5,600	4,585	38,751
Coho	—	—	—	3,800	2,223	11,118
Jones Creek Spawning Channel						
Pink	4,162	1985	2,020	19,600	9,428	44,194
Chum	698	1986-88	304	1,200	521	6,228
Eagle River Hatchery						
Chinook	776	1985-88	655	2,850	2,333	19,717
Coho	9,574	1986-87	5,616	16,200	9,477	47,397
Loon Creek Hatchery						
Chinook	503	1985-88	409	3,200	2,400	17,453
Quesnel River Hatchery						
Chinook	22,668	1985-88	18,587	51,100	41,841	353,599

* Includes facilities constructed prior to SEP.

1. Cassette loading at the Lower Kennedy Nuu-chah-Nulth project. This new incubation method is being tested with coho, but work with chinook is planned for the future.
2. Dead egg picking was one of the necessary activities for the Nuu-chah-Nulth tribal council during the winter.
3. Once the dead eggs have been removed, trays are repositioned.
4. Netting chinook for the San Juan project was successful. The project met its target of 350,000 eggs.



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West Coast Vancouver Island

San Juan Enhancement Society Project

This project is located on Four Mile Creek, a tributary of the San Juan River, near Port Renfrew. Its purpose is to enhance stocks of chinook, coho, sockeye and chum in the San Juan watershed.

The project began in 1977 and it operated as a volunteer project for three years. In 1980, it became a CEDP project. The project provides employment for one person on a full-time basis and for one part-time employee. Some members of the community are trained in the fish culture aspects of a small-scale hatchery. Volunteers collect the brood stock for the project.

In 1984, the hatchery incubated and reared chinook and coho. The project reached its chinook egg target of 350,000 for the first time in 1984. Also, of the chinook adults caught, 50 were marked, indicating that these fish were of hatchery origin. Hatchery production contributes to the commercial troll fisheries on the west coast of Vancouver Island.

The total egg capacity is 2,000,000; rearing space is the limiting factor.

The hatchery expects to continue its incubation and rearing activities in 1985, with emphasis on chinook production. Smolt traps will be constructed to aid in determining timing of coho outward migration, growth and survival rates.

Bioreconnaissance will be done this summer on the San Juan River by Small Projects Unit.

Contact: Barry Cordocedo, Project
Coordinator, Small Projects
Division.

Nitinat River Hatchery

Nitinat River hatchery is located at the confluence of the Nitinat and Little Nitinat Rivers, approximately 60 km southwest of Port Alberni.

This Japenese-style hatchery was designed to accommodate 28 million chum eggs and 1.5 million chinook eggs incubated in Heath trays.

Along with the production of 17.2 million chum fry, 2.57 million chinook smolts and 21,600 coho presmolts, two experiments were conducted. In a time and size at release experiment, two groups of chinook were released at the same time but at different sizes. In the second experiment, one group of chum salmon was treated with a Morphaline drip for a period of ten days prior to release. This chemical is being tested for its ability to improve homing response by returning adults.

The escapement of chum and chinook to Nitinat in the fall of 1984 was above average. The terminal fishery on chum salmon outside Nitinat Bar harvested 220,000 pieces. The numbers of eggs taken in fall 1984 were: 81,000 coho, 28,000,000 chum, 2,630,000 chinook plus 84,000 chinook from Sarita River, the latter being returned to their home stream at the presmolt stage.

Contact: Colin Harrison,
Enhancement Officer,
Enhancement Operations,
Wai Leung,
Sr. Project Engineer,
Engineering.

Robertson Creek Hatchery

Robertson Creek is located near the outlet of Great Central Lake approximately 15 km northwest of Port Alberni, off Highway #4. The main purpose of the Robertson Creek facility when it was established in 1959 was to produce pinks for the Somass system. It was also intended to develop runs of chinook and coho salmon.

Two major expansions of Robertson Creek, one in 1971 and the second in 1981, boosted production to 9 million chinook smolts, 1.5 million coho smolts and 250,000 steelhead smolts annually.

Japanese Keeper Channels for Chinook Salmon

The 1984 keeper channel experiment was the fourth in a series to determine optimum gravel size and alevin density for chinook at Robertson Creek.

This year, two sizes of gravel (50-76 cm and 76-101 cm) and three loading densities (10,000/12,500 and 14,000 per square metre) were used. Each of the three experiments are to be replicated once.

Nahmint River Chinook Satellite

In fall 1984, the Nahmint River was seined for brood stock. The resulting eggs were incubated at Robertson Creek hatchery. Presmolts will be released back to Nahmint River in spring 1985.

Very low water conditions followed by extreme flooding made brood stock collection difficult; 16,000 eggs collected. This should result in an estimated 12,000 smolts for release. All fry will be coded-wire tagged prior to release and adult returns will be monitored.

Public Participation Projects

The Alberni Volunteer Enhancement Society was given a coho egg allotment of 100,000 (green), to be incubated in Atkins boxes to eyed stage and then placed into keeper channels to button-up. The resulting fry will be released into tributaries of the Stamp River system.

The Ucluelet Volunteer Group under Bryan Allen were again given 100,000 coho eggs (green) for release into streams near Ucluelet.

Bulk Boxes

Ten bulk box incubators (80x60x50 cm) are being used in experimental trials using plastic substrate to incubate chinook alevins. It is hoped to determine optimum loading densities for chinook in these incubators. Migration from the boxes will be closely monitored to determine percentage of premature migration.

Job Creation Programs

Job creation programs provided for:

- tour guides for Robertson Creek
- updating nature trails for the public
- a 10 m extension of the existing workshop
- awareness programs with the schools
- open house at Robertson Creek.

Rivers Day

This year, Robertson Creek was picked as the site to host the Rivers Day Awareness Program, sponsored by the Outdoor Recreation Council of British Columbia. Rivers Day is a day proclaimed by the provincial government to increase awareness among British Columbians of the value of rivers within our province.

Public Awareness

Robertson Creek has become quite well known in the Alberni Valley for its contribution to the sport fishing industry. Tourists are more than welcome on site with an annual average of up to 400 visiting tourists per month. This, along with school presentations by our staff and tour guides, as well as coho incubators in five elementary schools and representation at the Alberni Fall Fair and Fishing Derby have all helped to make the public aware and keep them informed about the salmon resources in this area.

Water Filtration

A simple filter box has been successfully used to filter water for a bulk box incubator. Previously, suspended material has settled on eggs, alevins and screens, causing flow blockage and suffocation.

More detailed information on this appeared in DFO Info Memo #98.

Incubation of Steelhead
Presently at Robertson Creek an experiment has been designed for the incubation of steelhead eggs using a spray mist system. The eggs are placed on a vexar screen just above the surface of the water in a Capilano trough. The water supply for the eggs is distributed through a "soaker" hose (garden type) which is set up with a solenoid and timer. The eggs receive a light spray of water at timed intervals and for a specified duration.

This experiment, if successful, should help future incubation systems which have a limited supply of water. It may also help alleviate the problems associated with "crib death" which has been a major concern at Robertson Creek. Temperature units (ATUs) will be closely monitored as the eggs will be incubating at air temperature as opposed to water temperature.

An Info Memo will be distributed in regard to this experiment upon completion.

Contact: Don Lawseth, Stock
Enhancement Officer,
Enhancement Operations.

Thornton Creek Hatchery

This project is located at the mouth of Thornton Creek near Ucluelet and is operated by the Thornton Creek Enhancement Society, under contract to SEP.

The objective of the hatchery is to enhance the coho and chinook stocks in the area, particularly in the Kennedy River system. In addition, chinook and coho from Robertson Creek hatchery have been transplanted to try to establish a sport fishery in this area.

The project employs 2.5 people and also provides some seasonal work and training in fish culture to community members.

In 1984, the hatchery continued its regular operations and also completed the final year of a three-year chum sterilization program. The objective of the sterilization program is to develop a larger salmon that remains available to the fishery for a longer period of time. Since sterile fish do not mature sexually, their migration to fresh water to spawn is delayed or prevented.

In 1984, 140,000 chum fry were sterilized and a matching 140,000 became a control group. During the alevin stage, the experimental group was sterilized by being dipped in a testosterone MT and alcohol ETOH bath for two hours at a time, once a week for eight weeks. No tagging was done this year.

The project experienced its first coho and chinook returns to the hatchery in fall 1984.

An office building was constructed with funding provided through a job creation program.

Bioreconnaissance work in local streams was carried out by summer students for the third year. Maggie and Twin Rivers were surveyed.

The hatchery plans to continue incubation and rearing activities in 1985. Funds have been made available to complete an adult collection fence at the hatchery site. Construction should take place in summer 1985.

Contact: Barry Cordocedo, Project
Coordinator, Special Projects
Division.

Lower Kennedy Project

This project is located just above Lower Kennedy River rapids near Tofino.

The reasons for the project are:

- to test floating cassette incubators
- to provide employment for up to five people
- to improve Fisheries/Native relations
- eventually to enhance wild stocks in the area particularly chinook.

In 1984, a 15 m x 9 m floating net pen was constructed and experimental floating cassette incubators were installed. A small number of Kootowis coho eggs were used and will be used until approval is given to change to chinook. Approximately 25,000 coho eggs were collected.

Work to be done in 1985 includes construction of an access road to the hatchery site and construction of an office and storage building.

The eventual benefits will include enhancement of wild stocks in the area particularly the Lower Kennedy chinook as well as employment, training, and economic benefits to the community.

Contact: Barry Cordocedo, Project Coordinator; Al Keitlah, Project Manager

Tlupana Inlet/Conuma Hatchery

Conuma hatchery, located midway between Gold River and Tahsis on the Conuma River, is the northernmost major SEP facility on Vancouver Island's West Coast. Opened in 1978 with the principle aim of supporting a commercial chum fishery in Nootka Sound and Tlupana Inlet, this Japanese-style satelliting hatchery incubates eggs brought in from five streams (Conuma, Tlupana, and Sucwoa Rivers; and Canton and Deserted Creeks) flowing into Tlupana Inlet. Under the Japanese system, chum egg development is accelerated using well water, which is warmer than the winter river water. Newly hatched alevins are reared for six weeeks, first in covered "keeper" channels, then in earthen ponds, to about twice the weight of naturally rearing fish. They are released in their streams of origin when the wild fry migration peaks in early spring. Adult return rates to the five streams in fall 1984 indicated that there is some straying between streams among hatchery stocks. There is also some straying in naturally spawning stocks however, and the few days of imprinting that hatchery stocks get in home streams seems to be enough to guide the majority back to their point of origin.

For the third consecutive year, Conuma hatchery chum egg-takes reached the incubation capacity of the existing water system, and due to improving techniques, the hatchery was able to release a record 18.9 million chum in spring 1984.

Sea Pen Egg-takes

The sea-pen method of chum egg collection has been progressively successful over the last three years. This method, first used at Conuma in 1982, relies on seine capture of mature adults which are schooling in the river estuaries before making their final upstream migration. Fish are then loaded into net pens, sorted, killed and stripped on a floating work platform which can be towed from one estuary to the next. In terms of numbers of fish captured and processed in one day, this method is much more efficient than seining in the river, where fish are harder to capture.

In the first two years of sea pen egg-takes, higher mortalities in some egg lots pointed to a need for improvement of techniques. Research personnel from the Pacific Biological Station in Nanaimo studied the physiology of mature adults at the Deserted Creek sea pens in 1981 and 1982 and were able to make recommendations which have helped bring incubation mortalities down to normal levels. The two principal changes to the sea pen operation which contributed most to egg survival were: a reduction in the maximum holding time for mature non-ovulated female chum from 10 days to 3 days and the exclusive use of sperm from river-caught males for fertilization of all eggs from the rivers or the sea pens. With these methods, even the increased rearing capacity provided by doubling the number of wells and keeper channels in 1980 is fully utilized each spring.

Upwelling Incubators

Egg viability for chinook caught in the estuary is still a problem, however, so chinook caught while collecting chum are released. (See chinook and coho section following.)

In the incubation and rearing phase of 1984, increased numbers of chinook and coho were hatched and/or incubated from the early alevin stage to feeding fry stage in experimental upwelling incubator boxes. In each of these fabricated aluminum boxes filled with artificial substrate, 100,000 eggs can be incubated. The upwelling boxes were designed at Conuma to accommodate special groups of eggs too small in number to warrant the use of keeper channels, which are reserved for groups of over 500,000 eggs each, and as an alternative to the labor-intensive Heath trays used by many hatcheries.

During 1984, six of the nine box incubators in use were involved in an experiment to determine the optimum water flow rate and loading density in the boxes.

Coho Colonization

As in 1982 and 1983, coho colonization of the inaccessible rearing habitat on the upper Conuma River was accomplished by helicopter transport. This year 82,000 coho were flown and distributed in one day over 6 km of river, where they are expected to rear until their second spring . A small-scale habitat utilization study was undertaken in 1984 to determine which stretches of the upper Conuma coho use most heavily. In 1985, the study will be expanded and will focus on several local watersheds to provide baseline information for the development of a general Tlupana Inlet coho release strategy. Half of the Conuma coho hatched in 1983 were released in July 1984 to test existing research indications that ocean survival is highest for coho entering the marine environment in their second summer. This practice will again be followed with 1984 brood coho.

Increasing Emphasis on Chinook and Coho

Chinook releases in 1984 were down slightly from the hatchery record of 485,000 in 1983 to 449,000 despite there being more eggs taken in 1983 than in 1982. The reduced egg-to-fry survival, in brood year 1983 eggs as a whole, stems from the very high mortalities sufferred by egg lots taken from the sea pens. As there is as yet no way to predict which female chinook captured in the estuary will contribute viable eggs, the practice at Conuma henceforth is to release all chinook adults captured in the estuary and pick them up again one to two weeks later in the river.

In fall, 1984, for the first time, Conuma hatchery took chinook and coho eggs from Tlupana Inlet streams other than Conuma River. The anticipated increased interception rate on chinook and coho in the Tlupana Inlet commercial chum fishery has necessitated such a move. It is also felt there is good potential for a sport fishery on the inlet. Increased returns of hatchery chinook to Conuma River itself permitted a record chinook egg-take for the hatchery in 1984. By harvesting approximately half the escapement, the hatchery took 1.5 million Conuma chinook eggs, 380,000 Sucwoa chinook, 150,000 Tlupana chinook, as well as 300,000 coho eggs from the Conuma and 54,000 from the Sucwoa.

Commercial Fishing

The first commercial net fishery targeting on enhanced Tlupana Inlet chum was conducted in October, 1984 with good results. In two openings 100,000 silver-bright fish were harvested, leaving a more than adequate escapement for natural spawning and the hatchery. The target of 22 million chum eggs for 1984 was reached without difficulty. In future years, as adults from the larger releases at the hatchery return, the harvest of Tlupana chum stocks is expected to reach 300,000 with the likely inclusion of chinook once the success of that program is assessed.

Improved Water Quality

Construction of two new wells and an aeration tower was begun in winter 1984 with the potential of doubling the well water capacity at the hatchery. Once these wells come on line in early 1985, water quality will improve for the fish on hand. The new system, with the addition of a fourth earthen rearing pond envisioned for the near future will accommodate the anticipated continuing increases in chinook and coho rearing at the hatchery while allowing the maintenance of chum enhancement at present levels.

Research

In addition to the delayed release of coho smolts, five other major experiments or new techniques will be tested on brood 1984 eggs and fry. The effects on chinook fry out-migration and quality of different sizes and combinations of artificial substrate in aluminum upwelling incubators are being studied as is the effect of varying time and size-at-release on ocean survival of chum smolts. Other tests initiated by hatchery personnel include:

- the use of large (8-13 cm as opposed to 3-8 cm) gravel in chinook keeper channels
- pre-release feeding of fry and smolts on natural food
- sea pen rearing of chinook fry to the smolt stage.

Contact: Iain Maclean, Stock
Enhancement Officer,
Enhancement Operations.

Job Creation Projects

Stamp River Counting Fence

A weir was constructed at the upstream end of the fishway to aid in the enumeration of chinook and coho. This information was useful in planning the timing of egg-takes at Robertson Creek hatchery.

Robertson Creek Hatchery

Tag returns from chinook and coho were entered onto computer; coho, chinook and steelhead were enumerated through the Stamp Falls fishway; the Stamp River was assessed for spawner distribution and general improvements were made to the hatchery and site.

Nimpkish CEDP Project

The job creation crew repaired and renovated the hatchery at Cheslakee, monitored hatchery water quality and flow and assisted in brood stock capture (500 chum and 100 coho in Nimpkish River, and 1,800 sockeye and 45 chinook in Woss River).

Clayoquot Sound Project

The job creation crew conducted a stream assessment program of 43 creeks and rivers in Clayoquot Sound, concentrating mainly on assessing chum and coho spawners and identifying obstructions.

Some obstructions were removed and trails were cut along the stream banks to aid in future stream surveys.

Thornton Creek Hatchery Expansion

A job creation crew helped build an extension to the Thornton Creek hatchery near Ucluelet. They installed siding, windows, doors, and roofed the building. The extension will serve as a teaching facility to assist other community development projects in the area.

Contact: Chris deHrussoczy-Wirth,
Head, Employment Development,
Special Projects Division.

Table 13

Public Participation Projects

WEST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Memekay River	Pacific Trollers Assn. Sayward Fish & Game Club	18	8	incubation	coho	120,000	75	1,800
Nequiltpaalis Cr.	Western Forest Products	10	4	incubation	chum	3,500	100	70
Marble River	Western Forest Products	100	4	incubation	chinook	236,000	94	7,080
						There were 100,000 marked.		
					coho	36,000	90	600
Goodspeed River	Holberg Community	10	7	incubation	coho	1,400	5	17
						Broken pipeline resulted in high mortalities.		
Gold River	Gold River Rod & Gun Club	—	1	incubation	chinook	12,838	86	125
						There were 10,500 marked.		
Quatsino Creek	Quatsino School and Community	—	1	incubation	chum	500	100	4
Monkey Creek	Western Forest Products	—	1	incubation	coho	4,800	80	72

Contact: George Bates, SEP Community Advisor.

Robertson Creek/ Plested Creek	Alberni Enhancement Society	12	4	incubation	coho	104,800	88	1,258
Plested Creek	John Howitt Elementary School	35	3	incubation in school	coho	4,500	90	68
Sandhill Creek	Thornton Creek Volunteer Society	30	4	incubation	coho	80,000	88	1,200

WEST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Anderson Creek	Ahousat Indian Day School, Resource Technology School	4 6	4 3	information, incubation	chum	5,600 High mortalities due to fungus.	31	45
Robertson Creek	Alberni Elementary School	35	1	classroom incubation	coho	13,200 Fry returned to Robertson Creek hatchery.	83	158
Refuge Creek	Hot Springs Cove Elementary School	20	1	classroom incubation	chum	100	33	1
Robertson Creek	Redford Elementary School	30	1	classroom incubation	coho	Supersaturation killed all 4,000 incubating eggs.		
Thornton Creek	Ucluelet Secondary School	25	1	classroom incubation	chum	Shutoff of water supply killed all 6,000 incubating eggs.		

Contact: Bryan Allen, SEP Community Advisor.

Table 14

West Coast Vancouver Island SEP Facilities*: Juvenile Releases 1984

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
San Juan Enhancement Society Project						
Not available at time of printing.						
Nitinat River Hatchery						
Chinook	1983	Nitinat	2,570,176	4	88	5.3
Coho	1983	Nitinat	19,643	100	84	4.6
Chum	1983	Nitinat	3,107,614	3	91	0.5
Chum	1983	Nitinat	14,176,372	1	91	1.1
Robertson Creek Hatchery						
Chinook	1983	Robertson	9,599,318	3	89	5.4
Chinook	1983	Nahmint	43,775	99	N/A	3.3
Coho	1982	Robertson	1,269,181	7	81	16.0
Steelhead	1983	Robertson	121,187	99	N/A	54.9
Steelhead	1983	Somass	63,197	99	76	72.6
Thornton Creek Hatchery						
Not available at time of printing.						
Tlupana Inlet/Conuma Hatchery						
Chinook	1983	Conuma	457,500	22	82	5.3
Coho	1983	Conuma	82,000	64	N/A	5.2
Chum	1983	Conuma	4,546,000	0	90	1.4
Chum	1983	Sucwoa	4,481,000	3	93	1.0
Chum	1983	Tlupana	2,947,000	0	90	1.1
Chum	1983	Canton	876,000	0	91	1.2
Chum	1983	Deserted	6,114,000	2	94	1.0

* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 15

West Coast Vancouver Island SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
San Juan Enhancement Society Project							
Chinook	Harris Creek	84	egg	353,700	June 1985	318,330	Harris Cr.
Coho	San Juan R.	84	egg	1,163,750	May-June 1985	1,047,375	San Juan system
Nitinat River Hatchery							
Chinook	Nitinat	84	alevin	2,370,000	May 1985	2,340,000	Nitinat
Chum	Nitinat	84	egg	26,900,000	Apr. 1985	26,000,000	Nitinat
Coho	Nitinat	84	egg	77,000	N/A	70,000	Little Nitinat
Chinook	Sarita	84	egg	81,000	N/A	79,000	Sarita
Robertson Creek Hatchery							
Chinook	Robertson	84	egg	9,296,775	June 1985	9,000,000	Robertson
Chinook	Nahmint	84	egg	16,000	May 1985	12,000	Nahmint
Coho	Robertson	84	egg	1,789,907	Apr. 1986	1,500,000	Robertson
Coho	Robertson	83	presmolt	1,609,194	Apr. 1985	1,500,000	Robertson
Steelhead	Robertson	85	adult	107[1]	--	--	--
Steelhead	Somass	85	adult	44[1]	--	--	--
Steelhead	Robertson	84	presmolt	65,282	Apr. 1985	65,000	Somass
Steelhead	Somass	84	presmolt	127,503	Apr. 1985	127,000	Somass
Thornton Creek Hatchery							
Chum	Thornton	84	egg	292,360	April 1985	263,124	Thornton
Coho	Robertson	83	smolt	53,396	March 1985	53,300	Thornton
Chinook	Robertson	84	egg	40,000	June 1985	36,000	Thornton
Chinook	Lower Kennedy	84	egg	45,442	June 1985	45,000	L. Kennedy
Coho	Upper Kennedy	84	egg	48,220	June 1985	43,398	U. Kennedy
Coho	Kootowis	84	egg	47,227	June 1985	42,504	Kootowis
Coho	Staghorn	84	egg	16,518	June 1985	16,000	Staghorn
Lower Kennedy Project							
Coho	Kootowis	84	egg	19,520	June 1985	17,568	Kootowis
Tlupana Inlet/Conuma Hatchery							
Chum	Sucwoa R.	84	alevin	5,020,000	Apr. 1985	5,000,000	Sucwoa
Chum	Canton R.	84	alevin	1,070,000	Apr. 1985	1,060,000	Canton
Chum	Tlupana R.	84	alevin	1,610,000	Apr. 1985	1,580,000	Tlupana
Chum	Conuma R.	84	alevin	7,110,000	Apr. 1985	6,970,000	Conuma
Chum	Deserted R.	84	egg	5,100,000	Apr. 1985	5,060,000	Deserted
Chinook	Conuma R.	84	alevin	1,496,000	June 1984	1,450,000	Conuma
Chinook	Tlupana R.	84	alevin	150,000	May 1985	147,000	Tlupana
Chinook	Sucwoa R.	84	alevin	370,000	June 1985	362,000	Sucwoa
Coho	Conuma R.	83	presmolt	75,000	June 1985	75,000	Conuma
Coho	Conuma R.	84	egg	127,000	May 1985	125,000	Conuma
Coho	Conuma R.	84	egg	127,000	June 1985	123,000	Conuma
Coho	Sucwoa R.	84	egg	54,000	June 1985	48,000	Sucwoa

* Includes facilities constructed prior to SEP.

N/A means "not available."

[1] Adult steelhead being held as brood stock.

Table 16

West Coast Vancouver Island SEP Facilities*: Surplus Sales 1984

Species	Number Eggs/Juv.	Stage	Dis-position	Value ($)	Surplus Adult Sales (kg)	Value ($)
Nitinat River Hatchery						
Chum	--	--	--	--	32,558.75	3,255.88
Mixed[1]	--	--	--	--	3,309.57	66.20
Robertson Creek Hatchery						
Chinook	393,000	eggs	sales	3,930.00	22,888.20	38,216.76
Chinook	60,000	eggs	sales	840.00		
Coho	736,677	eggs	sales	7,366.77	21,123.72	16,525.16
Coho	263,680	eggs	research	--		
Steelhead	--	--	--	--	5,422.38	13,664.40
Mixed[1]	--	--	--	--	33,798.20	1,013.95
Tlupana Inlet/Conuma Hatchery						
Mixed[1]	--	--	--	--	58,443.93	6,428.84

* Includes facilities constructed prior to SEP.

[1] Returning species sold together.

Table 17

West Coast Vancouver Island SEP Facilities: Escapement to Facility 1984*

Species	Escapement to Facility	Spawned for Hatchery Stock male	Spawned for Hatchery Stock female	% Marked (male and female)
San Juan Enhancement Society Project				
Chinook	No escapement to facility	97	76	50
Coho		402	439	
Nitinat River Hatchery				
Chinook	17	N/A	494	41
Chum	16,516	N/A	10,809	N/A
Coho	49	N/A	26	40
Chinook	768	N/A	N/A	N/A
Chum	9,686	N/A	N/A	N/A
Chinook	17	0	17	0
Robertson Creek Hatchery				
Chinook	11,024	N/A	2,552	1
Coho	15,008	N/A	1,019	16
Steelhead	1,316	N/A	N/A	28
Thornton Creek Hatchery				
Chum	14,286	40	105	1
Coho	128	N/A	N/A	57
Chinook	46	N/A	N/A	52
Chinook (L. Kennedy)	brood stock	12	12	N/A
Coho (U. Kennedy)	brood stock	12	13	N/A
Coho (Kootowis)	brood stock	39	26	N/A
Coho (Staghorn)	brood stock	18	11	N/A
Lower Kennedy Project				
Coho	No escapement to facility	15	10	0
Tlupana Inlet/Conuma Hatchery				
Chum (Tlupana)	4,500	408	680	3
Chum (Conuma)	24,000	1,708	2,847	1
Chum (Sucwoa)	11,300	1,265	2,108	2
Chum (Canton)	3,000	316	527	5
Chum (Deserted)	12,000	1,278	2,130	1
Chinook (Tlupana)	65	23	28	1
Chinook (Conuma)	1,400	200	268	50
Chinook (Sucwoa)	135	20	67	3
Chinook (Canton)	35	N/A	N/A	36
Coho (Tlupana)	30	N/A	N/A	N/A
Coho (Conuma)	650	50	89	15
Coho (Sucwoa)	115	15	16	0
Coho (Canton)	25	N/A	N/A	N/A

* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 18

West Coast Vancouver Island SEP Facilities*: Adult Production

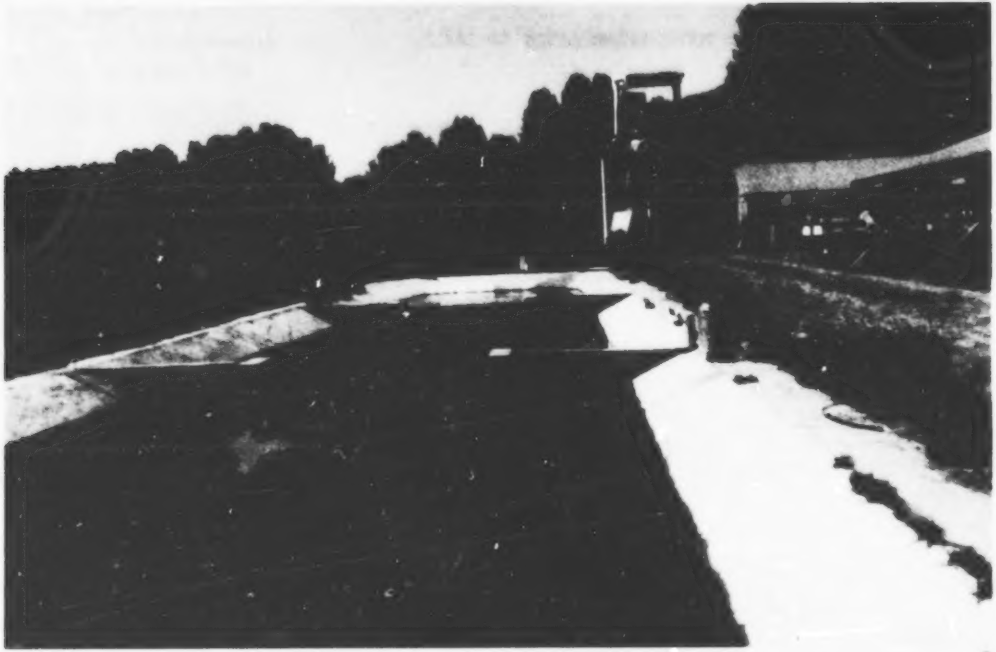
		Expected Production from 1984 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries (pieces)	Total Adult (pieces)	Contribution to Fisheries (pieces)	Contribution to Fisheries (lbs)
San Juan Enhancement Society Project						
Not available at time of printing.						
Nitinat River Hatchery						
Chinook	77,105	1985-88	41,326	75,000	40,200	391,272
Coho	395	1985-86	129	1,000	429	2,214
Chum	308,388	1986-88	135,696	340,000	149,600	1,686,590
Robertson Creek Hatchery						
Chinook	289,292	1985-88	155,065	274,000	146,864	1,429,447
Chinook	190,377	1985-86	81,682	150,000	64,350	332,122
Chinook	7,375	1986-90	6,660	7,500	6,750	69,525
Thornton Creek Hatchery						
Not available at time of printing.						
Tlupana Inlet/Conuma Hatchery						
Chinook	13,725	1985-88	6,247	43,000	19,608	223,325
Coho	12,301	1986-87	570	5,600	2,600	14,056
Chum	379,280	1986-88	166,892	302,000	132,880	1,456,631

* Includes facilities constructed prior to SEP.

1

1. This construction project was completed in 1984. The structure will permit flow control of the Quatse River.
2. Marks indicate various groups of fish. This chum was marked with the 1/2 dorsal clip prior to its release as a fed fry.
3. Cowichan hatchery, site of this raceway, has been making improvements. A new location for offsite cutthroat rearing began operation in 1984 and steelhead capacity at the netpens was doubled.

2



3

East Coast Vancouver Island

Cowichan Band Project

This project operates on the lower reaches of the Cowichan River at Duncan, Vancouver Island.

Its aim is to enhance wild stocks of chinook, coho and chum in the Cowichan River system, and provide full-time employment for five as well as some seasonal work. It also serves to increase public awareness of SEP through such things as hatchery tours.

Work done in 1984 included operation of a hatchery on the Cowichan River for incubation and rearing of chinook, coho and chum and completion of a concrete channel which will be used for chum rearing and adult holding. Screens were installed. Fry salvage was carried out in the Cowichan and Koksilah systems. Approximately 100,000 coho were salvaged. A river management program was incorporated into the CEDP contract for this year only. Duties included enforcement of Band by-law, adult enumeration and security. A transplant of 100,000 Cowichan chinook stock to the Koksilah River system was undertaken. The chinook egg target was increased to 500,000 and chum production will be reduced as there are adequate spawners in the system. Three 3.6 m circular tubs were hooked up.

This project contributes to the commercial, sport and Native food fisheries through fish production. It provides employment, training and economic benefits to the community.

Contact: Barry Cordocedo, Project Coordinator, Special Projects Division.

Vancouver Island Hatchery and Offsite Rearing

Vancouver Island hatchery is operated near Duncan by the Fisheries Branch of the Provincial Ministry of Environment. It produces both steelhead and anadromous cutthroat trout. The hatchery is entirely funded by SEP and was built in 1982 as an adult holding, egg incubation and fry rearing facility to supply both anadromous trout fry and smolts to several streams throughout Vancouver Island. The fry are reared at Vancouver Island hatchery while all smolt production is carried out at offsite rearing locations. While 1983 was the first full year of hatchery production, smolt production has been ongoing at the offsite rearing locations since 1979.

In 1984, adult cutthroat were collected either by electro-shocking or seining while angling was the primary method of steelhead collection. All adult brood stock were transported to holding facilities at Vancouver Island hatchery soon after capture. They were held there until maturation and were subsequently spawned.

Eggs were incubated either in wire baskets in troughs or in vertical incubators. The resulting fry were reared in troughs until their release time. Fry were outplanted to nine stream systems on Vancouver Island while the presmolts were transferred to offsite locations for further rearing. At release time, fry were either scatter-planted by hand in easily accessible areas or point-released in numerous remote locations by a device slung beneath a helicopter.

Tsitika River steelhead fry were again reared at Vancouver Island hatchery until summer and transferred to net pens at O'Connor Lake near Port McNeill for summer steelhead smolt production. At release time these fish are released into Campbell River as part of a program to establish a summer-run steelhead fishery to that river.

A total of 43,204 Englishman River eyed eggs were shipped from Vancouver Island hatchery to Big Qualicum hatchery for smolt production at that facility. Also, 1984 was the first year that Little Qualicum River anadromous cutthroat were incubated at Vancouver Island hatchery. A total of 8,906 eyed eggs were then shipped to Big Qualicum hatchery for cutthroat smolt production.

All anadromous cutthroat and steelhead smolt production was carried out at offsite net-pen rearing locations. Presmolts were transferred to these sites from Vancouver Island hatchery in early autumn and were fed by automatic feeders until smolting the following spring. They were then outplanted from these net pens to their respective streams.

In 1984, 43,058 steelhead smolts were released into the lower Cowichan River from the Cowichan net pens. All fish were adipose fin clipped for identification as adults. A total of 45,980 anadromous cutthroat smolts were also reared, fin clipped and released into three stream systems from two separate offsite rearing locations.

Two previous offsite rearing locations for cutthroat trout were disbanded during the summer of 1984 as a new centralized location nearer to the hatchery was discovered. Net-pen floats were dismantled, transported and reassembled in this abandoned and flooded limestone quarry location where anadromous smolt production is now underway. At the same time, the rearing capacity of the Cowichan net-pen operation was doubled to allow space for a twofold increase in steelhead smolts. In 1985, it is expected that 100,000 steelhead will be released from this facility; 50,000 to the Sooke River and the other 50,000 into the Cowichan River.

One serious incident of vandalism occurred at the Vancouver Island hatchery during summer 1984. Vandals entered the hatchery facility during off hours and destroyed a large number of fish as well as mixing several stocks of cutthroat and steelhead in different troughs. This resulted in a shortfall of fry for several stream enhancement programs. The vandals were never apprehended.

Contact: Ray Billings, Hatchery
Supervisor, Vancouver Island
Hatchery.

Chemainus River Hatchery

In 1984, for the sixth year, Chemainus River chinook and coho have been enhanced under contract by a small private hatchery on the Chemainus River. The program was initiated in 1979 in order to rebuild the remnant Chemainus River chinook stock which had dwindled to approximately 50 spawners in 1977. During 1979 and 1980 only chinook were enhanced but in 1981 coho were added to the program. The hatchery is currently owned and operated by Sea Spring Salmon Farms.

In spring 1984 189,574 chinook fry and 37,456 coho fry were released into the river. The chinook fry were marked with adipose clips and coded-wire tags in order to assess their survival. As well, an attempt was made to hold the chinook in pens in the river for a period of time to improve imprinting and subsequent homing to the river. Uncooperative river flows created difficulties for this part of the program, however, and the chinook were released prematurely. Survival is still considered to be good in spite of the problems encountered.

Due to poor returns of chinook in fall 1984, the egg target was not achieved. Consequently additional coho eggs were collected. In total, approximately 83,000 chinook eggs and 82,000 coho eggs were ultimately collected.

This program has been extremely successful to date with Chemainus River chinook responding well to the enhancement effort. The stock is well on its way to recovery and is also contributing to sport and troll fisheries.

Contact: B. Pearce, A/Unit Head, South Coast, Enhancement Operations.

Nanaimo Community Development Project

This project is located in the lower reaches of the Nanaimo River, at Nanaimo on the east coast of Vancouver Island.

The project is intended to enhance the chinook, coho and chum stocks in the Nanaimo River system. It provides full-time employment to six and some seasonal work. It also aims to increase public awareness of the Community Economic Development Program and SEP in general.

In 1984, the project operated a hatchery on the Nanaimo River for incubating and rearing chinook, coho and chum. In conjunction with the Pacific Biological Station, Nanaimo Community Employment Advisory Society continued a program in which approximately 1,200 Upper Nanaimo spring chinook fry are being held to adults. This particular stock is almost extinct and these will be used as brood stock. A new pump was installed and two extra covered raceways were constructed. This was funded through a Canada Works program. Stream improvements were carried out on Napoleon Creek, again funded through a Canada Works program. Net pens for spring chinook being held at PBS were constructed and a new header tank was installed.

This project contributes to the commercial, sport and Native food fisheries. It also provides employment and training and economic benefits to the local community.

Contact: Barry Cordocedo, Project Coordinator, Special Projects Division.

Little Qualicum Project

This facility is located on the Little Qualicum River, 2 km north of Qualicum Beach on Vancouver Island. It includes an artificial spawning channel for chum salmon and a rearing channel for juvenile chinook and steelhead trout.

The 4.16 km long by 7.5 m wide spawning channel will accommodate 50,000 spawners and produce an estimated 59 million fry annually. Escapements to the system have been below normal since the project began in 1979, but returns have been increasing steadily, and the channel should reach full production in the next 3 years.

The rearing channel has a capacity for 1.5 million chinook and 40,000 steelhead smolts. All fish for the rearing program are supplied from the Big Qualicum hatchery, making it possible to operate at full production since opening in 1980. A good return of chinook adults was experienced in 1984 with 800 adults held for brood stock, 277 adults and 754 jacks counted in the spawning channel, and an estimated 1,000 spawning in the river upstream of the diversion fence.

This project has the capacity to contribute over 150,000 chum, 30,000 chinook, and 1,000 steelhead to the sport, commercial, and Indian food fisheries annually.

The chum fry rearing program was continued in 1984, and released 2.8 million fed fry.

As a large number of chum adults (43,400) entered the channel of their own accord this year, the helicopter airlift of chum was not necessary.

Eight hundred chinook adults were captured and held for brood stock this year, with 434 females being spawned. The eggs were transported to the Big Qualicum hatchery for incubation.

Contact: Grant Ladouceur, Stock
Enhancement Officer,
Enhancement Operations.

Big Qualicum Project

The Big Qualicum River project is located on the east coast of Vancouver Island, approximately 60 km north of Nanaimo on the Island Highway. It was developed to increase the production of native stocks of chum, coho and chinook salmon, as well as steelhead trout through environmental control. The first stage of the project, completed in 1963, included the construction of facilities to allow year-round regulation of river discharge and to provide a degree of water temperature control during the summer and fall. The second phase was carried out from 1964 to 1967 and involved the construction of two artificial spawning channels. The latest stage in development is the hatchery program which began in 1968.

Flow control has more than doubled the egg-to-fry survivals for all species. Chum have received the most benefit from this situation because their production is not limited by the available rearing areas in the river.

The first spawning channel was originally built to accommodate a pink salmon introduction program and was later used as a chum and chinook salmon spawning channel. Design problems resulted in poor egg-to-fry survivals; therefore the channel was modified and it is now used to rear hatchery chinook and coho. The second spawning channel, designed specifically for chum salmon, has been extremely successful. This channel will accommodate 25,000 spawners producing up to 27 million fry annually, for an egg-to-fry survival of approximately 75 percent.

The hatchery program at Big Qualicum began as an experimental installation, testing various facilities and techniques for future hatchery development plans for other locations. After 1971, the hatchery became more production oriented. Since that time, it has expanded to become one of the largest production facilities in B.C. The present incubation capacity is 20 million eggs and the rearing capacity is 3 million coho smolts, 6 million chinook smolts, and 75,000 steelhead smolts. Several hundred thousand coho and chinook eggs are sold each year to private fish farms, some are used for research, and others go to public involvement projects. Also, 2 million chinook and 500,000 coho fry are used for recolonization of seven local streams. Steelhead smolts are produced for release into Big Qualicum as well as a number of other east coast Vancouver Island streams, including Little Qualicum, Englishman, Chase, and Millstone.

The Big Qualicum Project is currently operating at capacity, contributing approximately 250,000 chum, 200,000 coho, and 125,000 chinook to the sport and commercial fisheries, as well as up to 70,000 fish (most of which are coho) to the Indian food fishery annually. The value of this annual catch has been estimated to be over $12 million.

Special Activities

Hatchery rearing capacity has been doubled with the addition of two earthern rearing channels and a concrete raceway pond. A former experimental channel was deepened and widened and a fourth, new channel was constructed in the camp area.

Approximately 3.5 million coho juveniles (triple normal production) have been marked in preparation for release in the spring of 1985. It is hoped that these fish will enhance sport fishing in local waters during Expo 86.

Evaluation of a dry-feed diet formulated by the West Vancouver Lab is continuing at Big Qualicum. The freshwater growth of chinook fry fed on dry food is being compared to the growth of those fed on the standard OMP formula.

An experiment is underway to investigate the potential of sterilizing coho juveniles to increase their contribution to saltwater fisheries while at the same time reduce overescapement to the river. Approximately 70,000 fish have been sterilized and given an identifying coded-wire tag in preparation for release in the spring of 1985. If these fish perform as hoped, the program may be expanded in the future.

Contact: Grant Ladouceur, Stock Enhancement Officer, Enhancement Operations; Gregg Morris, Sr. Project Engineer, Engineering Division.

Puntledge River Hatchery

The Puntledge hatchery is located 2 km from Courtenay on Vancouver Island. The main hatchery site has been operational since 1979, full production target date is 1989. The hatchery complex consists of three sites; the upper site, the lower or main site and Tsolum project.

The upper site is located 9 km upstream from the main site. It facilitates the capture of adult summer chinook and summer steelhead and the rearing of summer chinook, coho and summer steelhead.

The lower site facilitates all incubation, the capture of fall chinook, coho, pinks, and chum and the rearing of fall chinook, pinks, chum and winter steelhead.

The Tsolum River project is a satellite of the Puntledge hatchery and is operated fully from the main site. The project facilitates the trapping and holding of adults and the rearing of Tsolum River pink salmon.

Summer chinook

A time and size at release study was initiated with the 1982 brood summer chinook to see if the smolt-to-adult survival can be increased. This study was continued with the 1983 brood summer chinook.

Fall chinook

The escapement of 1984 brood fall chinook to the Puntledge River system was a disappointment. With only 18,000 fall chinook eggs taken, it was decided that the run should be enhanced with a transplant from another river system similar to the Puntledge. Quinsam River hatchery, located 48 km north of the Puntledge, also on the east coast of Vancouver Island, has a fall run of large chinook similar to those in the Puntledge. Quinsam River hatchery supplied 200,000 eyed eggs from their 1984 brood chinook for transplant into the Puntledge River. All of these Quinsam chinook will be marked before release so that the returning adults may be identified.

Coho

This was the fourth year of the coho colonization program to the upper Comox Lake watershed, and the first year of colonization to the Tsolum River watershed. Approximately 2.75 million of the 1983 brood coho were transplanted to the upper Comox Lake system in June 1984 at an average size of 3g. A further 345,000 1983 brood coho were transplanted to the Tsolum River system in August 1984 at an average size of 7.4g. Eight groups of these colonization fish were marked with different coded-wire tags to assess the survival from various release sites.

Chum

Chum production reached a target of 7.5 million eggs with the 1984 brood stock. Japanese-style keeper channels were loaded to capacity with 5.1 million chum eggs and the remaining 2.4 million eggs were incubated in aluminum upwelling boxes. Studies were carried out to evaluate the use of plastic media vs gravel in upwelling boxes as well as the use of a screened intake vs a PVC pipe manifold system.

Pinks

Pink returns to the Puntledge and Tsolum River systems have reached critically low numbers despite enhancement efforts. Although there are many factors contributing to the decline in these stocks, one serious concern has become apparent in 1984 and work is now under way with the Waste Management Branch to determine if the high levels of copper found in water analysis are toxic to fish in the Tsolum River. Toxicity tests are currently being carried out at Puntledge hatchery and water quality is being monitored from various sites in the Tsolum River watershed which receive run-off from an abandoned copper mine on Mount Washington.

Contact: Harry Genoe, Stock
Enhancement Officer,
Enhancement Operations.

Quinsam River Hatchery

The Quinsam River hatchery is located 5 km west of the Campbell River townsite. Operation began in 1974, with original production targets of 1.2 million coho, 1.5 million chinook and 20,000 steelhead smolts.

Major changes in production targets were undertaken in 1979; 2 million pink salmon were added to the production, which has since grown to the current 7 million figure. For 1983, the coho target was increased to 2 million in anticipation of Expo 86.

Expansion of Quinsam hatchery in 1984 allowed an increase in production targets. The annual targets increased for both chinook and coho with releases of 3 million chinook smolts and 1.6 million coho smolts. As well, 100,000 coho fry will be reared until fall 1985, and then distributed to rear in the upper Quinsam watershed. Releases for 1985 will also include 3 million unfed pink fry, 2 million pink fry reared in pens in the estuary, and 21,000 steelhead smolts.

Preliminary targets for 1985 brood are 1.6 million coho smolts, 3 million chinook smolts, 100,000 coho for colonization, 7 million pink fry, and 20,000 steelhead smolts.

During 1984, the pink salmon offsite rearing program was repeated in the Campbell River estuary and plans are to expand it in 1985.

In 1984, chinook returns to the Campbell and Quinsam Rivers totalled 3,976 fish. Of these, 1,002 chinook averaged 10 to 20 kg and spawned naturally in the Quinsam River. Another 1,677 were used in the hatchery for brood stock. In 1984, 27,313 coho adults returned to the Quinsam River.

Special Studies

a) Coho colonization

Natural coho spawning and colonization of 243,000 fed fry in the fall of 1983 produced a migration of 96,000 smolts during spring, 1984.

In fall 1984, 101,302 reared fry (6.4 g) were transported and released in the Upper Quinsam River. A helicopter was used again to transport the fish, which were stocked at a density of 5,000 to 6,000 per km.

b) Surface water vs. groundwater smolting study

The second year of this test is underway with 1983 brood coho utilizing the Burrows pond that was converted for use with surface water. This will allow comparison of survival to adult between coho smolted on surface water and coho smolted on ground water.

c) An alternate rearing facility for coho smolts - effluent clarifiers

These units have continued to be used with the increased production of coho for Expo 86. An additional 750,000 coho smolts are scheduled for release in May 1985.

d) Genetics study

A genetics program utilizing 1983 brood coho adults is under way. The object of this study is to determine if the size of adults returning can be increased by utilizing the largest fish in the brood stock. These groups are marked to differentiate them from the regular production group and the Expo production group.

e) Pink enhancement

Six million pink salmon eggs were incubated in Heath trays. The resulting alevins were surface planted into gravel boxes. Upon emergence in 1985, approximately 2 million will be transported to the estuary and reared in net pens. The balance will be released directly into the Quinsam River. In addition pink eggs collected from Bear River by FSB were incubated at the hatchery and the fry were later transferred back to the Bear River for rearing. This work was done in cooperation with FSB.

f) Quinsam River watershed study

A watershed program was undertaken involving various job creation crews and Quinsam hatchery staff to gather baseline water quality data. Additional information was gathered on utilization of this area by colonized coho and steelhead.

g) Enhancement Planning

Significant time and effort was provided in 1984 for chinook enumeration of the Campbell/Quinsam River system in cooperation with FSB and PBS, and for planning for Campbell River side channel development.

Involvement continued in the following programs:

- Campbell River estuary study, with PBS staff
- Feed study adult recoveries, with PBS staff
- Density study adult recoveries, with PBS staff
- Chinook time and size adult recoveries, with PBS staff.

h) Maintenance

Several repairs were carried out at Quinsam hatchery this year, including diversion of a heavy sediment bearing tributary of Cold Creek around the dam, design and purchase of a new winch for the counting fence and design and purchase of a floating deflection screen for the Cold Creek intake at the dam.

i) Construction

A rearing channel was installed on land between the hatchery and the river. Two earthen channels 5.5 m wide by 111 m and one 76 m long and 1.2 m deep were constructed at a cost of $250,000. These channels use two water supplies, gravity flow hatchery reuse and pumped Quinsam River water. This increases the available rearing area for coho and frees up Burrows rearing ponds for increased chinook production.

j) Public relations

Involvement in the community increased in 1984 with the initiation of school training at the grade five level. This educational package focuses on the need for enhancement, contrasting natural vs. artificial methods, and points out the benefits of SEP.

The hatchery was the first to become involved in the DFO Awareness Campaign. DFO participated actively in the Salmon Festival with many displays, such as fish processing, and a cooking demonstration booth was set up on the festival grounds. A hatchery open house was held through the three days of the Salmon Festival. All these activities added to public knowledge and were also beneficial to the staff who participated.

In conjunction with the Salmon festival, a crew comprised mainly of hatchery personnel entered the Campbell River raft race. They greatly enjoyed the successful outing and their second win in as many years.

Contact: Jim VanTine, Stock
Enhancement Officer,
Enhancement Operations; James
Yong, Project Engineer,
Engineering.

Nimpkish Hatchery

The Nimpkish Band now operates two hatcheries, Willow Creek, located at the southwest end of Nimpkish Lake and the Cheslakee hatchery located 0.5 km upstream from the mouth of the Nimpkish River. The two facilities are designed to produce up to 3.5 million sockeye fry, 150,000 chinook fry, 150,000 coho fry and 1.4 million chum fry annually. All these stocks will contribute to the native, commercial and sport fisheries in the Queen Charlotte Sound/Broughton Straight areas.

Sockeye

In April and May 1984, 2.4 million sockeye fry from the 1983 brood year were released from the hatchery at various locations throughout the Nimpkish watershed. The hatchery had its best egg collection to date, collecting a total of 3.5 million sockeye eggs this past fall which will be released in spring 1985.

Chinook

The hatchery crew coded-wire tagged 22,000 of the 76,800 chinook fry from the 1983 brood year before releasing them in July. In fall 1984 the hatchery crew collected 157,000 chinook eggs from the Woss River, a major tributary of the Nimpkish River.

Coho

In spring 1984 403,000 chum fry from the 1983 brood year were released from the newly developed Cheslakee hatchery. 200,000 of these fry were raised to 1.5 g before being released in time to coincide with the natural chum fry migration. A total of 1.2 million chum eggs were taken this fall and are incubating at the hatchery.

Overall, 1984 was quite successful for Nimpkish project. It was the most successful year to data for capturing brood stock and collecting eggs. In addition to the increase in fish production, this project has continued to provide employment for four full-time and up to six part-time employees.

Contact: Colin Masson, Project Coordinator, Special Projects Division.

Quatse River Flow Control

The Quatse River flow control is a concrete weir structure constructed at the outlet of Quatse Lake, near Port Hardy. The weir is designed to allow the storage of run-off waters during the late winter and spring for release during the low-flow summer period.

The purpose of the weir is to supplement naturally occurring low-flow in the Quatse River during August and early September and thus enhance the quality and quantity of downstream aquatic habitat. The weir incorporates an overflow section approximately 27.4 m long between abutments and a control section that is 4.6 m long. The amount of water stored in the lake can be adjusted by adding or removing stoplogs at the control section of the weir. The control section consists of three bays of stoplogs, each approximately 1.5 m wide. An aluminum pool and riffle fishway will be installed in the bay nearest the access road during 1985, leaving two bays for use in adjusting lake storage and downstream flows.

The weir was designed to provide 11,326 L/second-days of water storage for release during low-flow periods. The design assumed flow supplements above the natural flow of 141 L/s for a six-week period and of 708 L/s for one week. The overflow of the weir section is designed to prevent the lake elevation from exceeding natural levels at a flood flow of 45,300 L/s.

Construction of the weir was undertaken in conjunction with the Northern Vancouver Island Salmonid Enhancement Association who will be operating the structure.

Contact: Russ Doucet, Project Engineer, Small Projects Unit.

Northern Vancouver Island Salmon Enhancement Association (NVISEA)

The Northern Vancouver Island Salmon Enhancement Association (NVISEA) is registered as a nonprofit society in British Columbia. The Association's main objective is enhancement of the salmonid stocks on Northern Vancouver Island.

The Association was formed in 1982 and began on-site work in 1983. It now operates two hatcheries at Quatse River and Stephens Creek.

The Association obtained help from a job creation program in 1984 and had a very active year. At Quatse the crew took approximately 903,000 pink, 84,000 chum and 130,000 coho eggs from the Quatse River and 691,000 pink, 8,000 chum and 192,000 chum from the Cluxewe River.

The Stephens Creek hatchery took 567,000 chum and 120,000 coho eggs from Stephens Creek and 83,000 pink, 200,000 chum and 23,000 coho eggs from the Waukwaa Creek. As well, the project took 10,000 chum and 60,000 coho eggs from Wanokana Creek for incubation at Stephens.

Contact: George Bates, Community Advisor, Special Projects Division.

Colonization Program

The colonization program is directed towards the enhancement of coho and possibly chinook salmon. It utilizes rearing habitat that is normally inaccessible to migrating fish, principally because of natural barriers.

A salmon habitat inventory program (SHIP) has identified hundreds of kilometres of low-gradient areas within upper watersheds which could have the potential for fry rearing. If these areas are planted with fry from wild stocks, either indigenous to the specific system or from adjacent systems, the technique could assist in rebuilding wild populations.

Currently there are eight such pilot projects underway on the east coast of Vancouver Island designed to gather information on the carrying capacity of various habitat types, the adaptation of various stocks (ecotypes, phenotypes) to different habitats and the technical problems that must be addressed to make colonization a viable program.

Finding a cost efficient means of generating fry from wild stocks will be a major challenge. If carried out in part in conjunction with existing facilities, it will require a move towards a multistock operation. Another alternative may be the use of enclosed, groundwater-fed side channels to generate fry.

Manpower requirements will be seasonal and will offer additional employment opportunities to groups such as commercial fishermen.

Colonization should provide low cost natural rearing without requiring large expenditures of capital.

Contact: Bob Hurst, Biologist, Small Projects Unit, Special Projects Division.

Provincial Status Report

In 1984, five federal, one provincial, and one community development facility were involved in the culture of 11 steelhead stocks from 10 watersheds. Green egg production for the 1983 brood totaled 1.3 million from which 277,500 fry and 483,250 smolts were liberated. The expected returns from these releases total 1,700 and 14,000 adults, respectively.

The hatchery steelhead production program has been well received by anglers. Hatchery fish comprised 66 percent of the estimated 4,500 steelhead caught and retained on Vancouver Island in 1983/84 and 28 percent of the total catch (hatchery plus wild; released and killed) of 47,082 on Vancouver Island.

Once again, the wild steelhead production program on Vancouver Island focused on management by regulation. Evaluation of regulations imposed in 1979 to reduce wild steelhead harvest and increase escapement continued in 1983. Catches in the 1983/1984 were the highest ever recorded as the first generation response to the regulations materialized. The total regional catch of 34,122 wild steelhead was the highest ever recorded and compares to historical averages of 20,000 - 25,000 fish. Angler effort continued to increase with 47,777 angler days expended on steelhead fishing.

Steelhead Assessment

The other major thrust in the Vancouver Island steelhead program is stock assessment. Continued assessment of wild and hatchery stocks used snorkel surveys, electrofishing surveys, habitat capability analysis, smolt enumeration, commercial and native interception, Floy/radio tagging and coded-wire tagging analysis.

Some of the interpretations from this work indicate that wild steelhead stocks in streams whose habitat was relatively stable responded quickly to increased escapements. Catches rose sharply four and five years after implementation of kill reductions. However, in streams impacted by forest harvesting the responses were not significant. In yet another category of streams, it appeared that illegal harvest of steelhead by gillnets has served to keep steelhead production well below its estimated potential.

Cutthroat Trout

There were major cutbacks in the anadromous cutthroat trout program on Vancouver Island due to funding constraints. Smolt releases were reduced from 50,000 to 30,000 cutthroat, and fry releases were reduced from 150,000 to 75,000.

A major part of the effort on cutthroat was spent assessing returns of hatchery and wild cutthroat trout to the Oyster River fishery, where 10,000 sea-run cutthroat smolts are released each year. The hatchery plants have resulted in an increase in angling effort from 1,600 hours in 1980 to 5,000 in 1984. Total catch of cutthroat for the same period increased from 200 to 1,700, and angler success also increased from 0.12 fish per hour to 0.34 fish per hour.

Work was also completed on mapping high quality cutthroat trout habitats on the east coast of Vancouver Island. This is required for future management actions.

Contact: George Reid, Head, Fisheries
Section, Fisheries Branch.

Job Creation Projects

Craigflower Creek

The job creation crew carried out a number of small projects on Craigflower Creek:

- built a counting fence
- cleared the stream of debris
- salvaged fry
- conducted a stream survey and escapement counts
- captured brood stock and took 30,000 coho eggs for Goldstream hatchery.

Bear River Hatchery

A counting fence was constructed on Bear River. A live box was incorporated into the fence to facilitate brood stock capture and 70,000 pink eggs were collected and transported to Quinsam hatchery for incubation.

Port Hardy Area

For the Stephens Creek and Quatse River hatcheries, the job creation crew carried out various hatchery maintenance and improvement projects, captured pink, chum and coho brood stock, assisted in egg-takes and cut trails to assist in brood stock capture.

The crew also fed and sampled steelhead fry in the O'Connor Lake net pens and assisted in coded-wire tagging of coho juveniles.

Big Qualicum Hatchery

This project had two components: public education and fish culture. Displays, signs, slide shows, games and a nature trail were the major elements of the public education component.

The job creation crew assisted in most of the general hatchery operations, including egg-takes, fin-clipping, feeding, clean-up and maintenance.

Quinsam Hatchery

The job creation crew at this hatchery helped in several areas, including:

- coho spawner distribution survey of most of the Quinsam watershed
- coded-wire tag data analysis
- biological monitoring
- egg-takes
- counting fence, rearing channel, pond and dam cleaning
- head recovery sampling
- fry marking
- creel study
- general clean-up.

Coho Brood Stock for Hatcheries

Workers on this project captured coho brood stock from Koksilah River and Nanoose, Craig, French and Black Creeks. Each coho was transported to the hatchery (Cowichan, Nanaimo, French Creek, Big Qualicum, and Quinsam) nearest the stream in which it was caught.

The project provided 150,000 eggs to the hatcheries.

Cowichan River

The Cowichan Band sponsored this project to assist the Band in its enhancement operation on the Cowichan River. The crew captured chinook, coho, and chum brood stock in the Cowichan River. They planted 200,000 chinook eggs, 300,000 coho eggs and 1.1 million chum eggs in the hatchery's incubator. In addition, the workers caught coho brood stock in Glenora Creek and they built a boat storage shed. Hatchery staff provided extensive technical advice on hatchery operations to the crew.

Quadra Island

The Quadra Island Salmonid Enhancement Society was responsible for this job creation project. The crew walked nine creeks on Quadra Island, counting chum and coho spawners. In Hyacinthe Creek, they added gravel to increase the spawning area; in Village Bay Creek they cleared debris and cleaned the spawning gravel. The crew participated in a number of other activities, including:

- capturing coho brood stock and taking 35,000 eggs for the Hyacinthe hatchery
- monitoring the progress of the incubating coho eggs and 85,000 chum eggs
- upgrading the hatchery building and completing general maintenance chores
- building a hatchery office
- improving the road to the Drew Creek incubation box site.

Nanaimo River Chinook

A job creation crew constructed a net and floats for a chinook sea-pen installation at the Pacific Biological Station and built a rearing channel at Nanaimo River for use by the Nanaimo community development project.

Contact: Chris deHrussoczy-Wirth,
Head, Employment Development,
Special Projects Division.

Table 19

Public Participation Projects

EAST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Goldstream River	Amalgamated Conservation Society	100	8	incubation, stream improvement, feeding	coho chinook	55,000 23,980	85 90	596 115
Goldstream River	Discovery Elementary School	33	4	incubation in school	chum	70	2	1
						High mortality during school spring vacation; cause unknown.		
Goldstream River	Shawnigan Lake School	60	5	incubation, rearing, feeding	chum	17,500	88	140
Shawnigan Creek	Mill Bay & District Conservation Society	12	6	fry release	coho	4,000	—	60
						Fry were from Goldstream River.		
Coonskin Creek/ Bear Lake	Yount Elementary School	30	5	incubation	coho	10,000	80	150
Sooke River/ Rocky Creek	Sooke Conservation Society	36	8	incubation	coho chinook	130,128 52,581	88 97	1,952 252
Colquitz River	Colquitz Enhancement Group	8	1	incubation	coho	16,000	—	240
Beaver Creek	Cowichan Lake Volunteer Society	20	1	stream improvement, spawner enumeration, feeding	coho	—	—	—
Koksilah River	Cowichan Valley Regional District	6	1	incubation	coho	3,800	76	46

EAST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Craigflower Creek	Marler Conservation Society	4	1	stream assessment, feeding	coho	—	—	—
Reay Creek	Sidney Anglers Association	15	3	fry release	coho	2,000 Fry were from Goldstream River.	—	30

Contact: Trevor Morris, SEP Community Advisor.

Green Creek	South Van. Is. Save the Fish Society	3	7	stream improvement, spawner enumeration, instream feeding	—	—	—	—
Cowichan River	Stanley Gordon Elementary School	10	1	stream improvement, fry salvage, feeding	coho	Assisted Yount Elementary School project.		
Tod Creek	Tod Creek Enhancement Society	20	2	fry release, feeding, stream improvement	coho	2,700 Fry were from Goldstream River.	—	41

Contact: Trevor Morris, SEP Community Advisor.

Millstone River System	Nanaimo Fish & Game Protection Assn.	120	5	fry release	coho	20,542 Transplant from Nanaimo River.	—	616
French Creek	Parksville-Qualicum Rod & Gun Association	25	4	incubation	coho	All 15,000 eggs killed; cause was an algae growth		
Beach Creek	Parksville-Qualicum Rod & Gun Association	30	5	incubation	coho	19,000	95	228
Trent River/ Puntledge River	Courtenay District Fish & Wildlife Protective Assoc.	25	7	incubation	coho cutthroat	180,000 1,100	90 28	2,700 15

EAST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Roy Creek	Cumberland Chamber of Commerce	5	4	incubation	coho	19,000	95	228
Craig Creek	French Creek Boat Owners' Association	15	1	stream improvement	coho	—	—	—
Drew Harbor Creek	April Point Flyfishing Club	10	6	incubation	chum	78,000	98	624
Hyacinthe Creek	Quadra Island Salmon Enhancement Society	20	5	incubation	coho chum	100,000 25,000	74 80	1,500 200
Granite Bay Creek	Granite Bay Conservation Society	3	5	incubation	pink	95,000	95	2,375

Contact: Bryan Allen, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Charles Creek	Alert Bay Fishermen's Society	15	2	incubation	chum	Planted 76,140 eggs from Viner Creek.		
Rough Bay Creek	Sointula	4	1	incubation	coho	4,900	94	65

Contact: George Bates, SEP Community Advisor.

Table 20

East Coast Vancouver Island SEP Facilities: Juvenile Releases 1984*

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Cowichan Band Project						
Not available at time of printing.						
Vancouver Island Hatchery						
Steelhead	1983	Cowichan	42,058	100	N/A[1]	44.5
Steelhead	1983	Tsitika	5,051[2]	100	N/A	72.5
Steelhead	1984	Cowichan	12,460	0	N/A[3]	0.9
Steelhead	1984	Cowichan	19,939[4]	0	N/A[3]	1.5
Steelhead	1984	Salmon	87,881	0	93	1.0
Steelhead	1984	Nanaimo	34,008	0	N/A[3]	2.1
Steelhead	1984	Englishman	29,820	86	N/A[5]	2.8
Steelhead	1984	Tsitika	19,608[6]	0	N/A[3]	3.7
Cutthroat	1982	Colquitz	502	100	N/A[1]	400.0
Cutthroat	1983	Oyster	10,450	100	N/A[1]	62.1
Cutthroat	1983	Colquitz	25,132	100	55	51.6
Cutthroat	1983	Nanaimo	10,398	100	74	53.9
Cutthroat	1984	Sandhill	954	0	90	0.5
Cutthroat	1984	Fulford	6,860	0	66	1.5
Cutthroat	1984	Fulford	6,082[7]	0	66	2.3
Cutthroat	1984	Colquitz	2,366	0	N/A[5]	6.9
Cutthroat	1984	Colquitz	17,748[8]	0	96	1.5
Cutthroat	1984	Oyster	6,782	0	N/A[3]	4.2
Cutthroat	1984	Nanaimo	5,874	0	75	9.4
Mixed[9]	1984	Various	13,211	0	N/A[5]	4.8
Chemainus River Hatchery						
Chinook	1983	Chemainus	189,574	37	94	8.2
Coho	1983	Chemainus	37,500	0	93	5.1
Nanaimo Community Development Project						
Not available at time of printing.						
Little Qualicum Project						
Chinook	1983	BQ & LQ	1,249,229	8	87	7.2
Steelhead	1983	BQ R.	36,964	100	66	61.3
Chum	1983	channel	18,932,000	1	47	0.4
Chum	1983	reared	2,550,863	3	--	0.7
Big Qualicum Project						
Chinook	1983	Big Qualicum	3,176,980	6	85	8.4
Coho	1982	Big Qualicum	1,254,697	35	60	17.0
Steelhead	1983	Englishman	31,238	100	86	56.6
Steelhead	1983	Big Qualicum	35,599	100	66	58.9
Chum	1983	river	33,875,000	1	24	0.4
Chum	1983	channel	24,325,000	1	69	0.4

Table 20 (Cont'd)

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Puntledge River Hatchery						
Chinook	1983	summer run	677,467	7	89	8.0
Chinook	1983	fall run	120,684	42	89	8.7
Coho	1982	Puntledge	1,270,108	7	84	20.4
Coho	1983	transplant	3,100,455	5	--	3.8
Chum	1983	Puntledge	6,506,343	2	96	1.0
Pink	1983	Tsolum	41,156	0	95	0.2
Pink	1983	Puntledge	711,544	0	82	0.2
Steelhead	1983	Puntledge	30,348	100	--	53.0
Quinsam River Hatchery						
Chinook	1983	Quinsam	1,446,870	8	80	13.3
Coho	1982	Quinsam	1,174,053	27	55	22.6
Coho	1983	Quinsam	101,302	100	--	6.4
Pink	1983	Quinsam	6,947,445	3	91	.2-.5
Steelhead	1983	Quinsam	19,900	100	70	64.1

* Includes facilities constructed prior to SEP.
N/A means "not available."
[1] Figure not available as portion of brood year was released in 1983.
[2] Reared at O'Connor net pens; released into Campbell River.
[3] Figure not available as portion will be reared for release in 1985.
[4] Surplus fry released into Mayo Pond, Shaw Lake, Weston Lake.
[5] Figure not available due to undetermined losses from vandalism.
[6] Transferred to O'Connor Lake for further rearing.
[7] Released into Colquitz River.
[8] Progeny of brood stock from Colquitz River.
[9] Cutthroat and steelhead mixed due to vandalism; released into St. Mary Lake.

Table 21

East Coast Vancouver Island SEP Facilities: Status at December 1984*

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Cowichan Band Project							
Chinook	Cowichan	84	egg	209,853	May 1985	113,868	Cowichan
						75,000	Koksilah
Coho	Cowichan	84	egg	288,175	Sept. 1985	259,357	Cowichan
Coho	Koksilah	84	egg	34,603	June 1985	31,143	Koksilah
Chum	Cowichan	84	egg	1,008,646	April 1985	90,778	Cowichan
Vancouver Island Hatchery							
Cutthroat	Oyster[1]	84	presmolt	16,300	May 1985	16,000	L. Oyster
Steelhead	Nanaimo[2]	84	presmolt	22,400	May 1985	21,500	Nanaimo
Steelhead	Cowichan[3]	84	presmolt	105,000	May 1985	103,000	Cowichan
Steelhead	Cowichan[4]	84	presmolt	10,900	March 1985	10,500	various lakes
Chemainus River Hatchery							
Not available at time of printing.							
Nanaimo Community Development Project							
Chinook	Upper Nanaimo	84	alevin	18,708	March 1985	16,837	Upper Nanaimo
Chinook	Upper Nanaimo	84	alevin	86,328	June 1985	77,695	Upper Nanaimo
Chinook	Lower Nanaimo	84	alevin	262,459	June 1985	236,213	Lower Nanaimo
Chum	Nanaimo R.	84	egg	997,390	April 1985	897,651	Lower Nanaimo
Coho	Nanaimo R.	84	egg	245,572	June 1985	211,014	Nanaimo
Coho	Millstone	84	egg	151,557	June 1985	136,401	Millstone
Little Qualicum Project							
Steelhead	B. Qualicum	84	presmolt	30,000	May 1985	28,000	L. Qualicum
Chum	L. Qualicum	84	egg	55,000,000	Apr.- May '85	35,000,000	L. Qualicum
Big Qualicum Project							
Coho	BQ	84	egg	5,500,000	May 1986	3,500,000	BQ
						500,000	colonization & C.D.P.
Coho	BQ	83	pre- smolt	3,5000,000	May 1985	3,300,000	BQ
Chinook	LQ	84	alevin/ egg	1,628,000	June 1985	1,350,000	LQ
Chinook	BQ	84	alevin/ egg	4,840,000	June 1985	4,400,000	BQ
Chum	BQ-wild	84	egg	100,000,000	Mar.- July '85	27,000,000	BQ
Steelhead	BQ brood stock	85	adult	1	May 1986	25,000	BQ
					May 1986	10,000	colonization
Steelhead	BQ	84	presmolt	36,940	May 1985	25,000	BQ
						10,000	colonization
Steelhead	Eng. R.	84	presmolt	26,866	May 1985	26,000	Eng. R.
Cutthroat	LQ	84	presmolt	2,773	May 1985	2,700	N/A

Table 21 (Cont'd)

				No. on	Expected Release		
Species	Stock	Brood	Stage	Hand	Date	Number	Site
Puntledge River Hatchery							
Chinook	summer run	84	egg	1,240,000	June 1985	1,150,000	Puntledge
Chinook	fall run	84	egg	17,000	June 1985	16,000	Puntledge
Chinook	fall run	84	egg	200,000	June 1985	185,000	Puntledge
Coho	Puntledge	83	fry	1,000,000	May 1985	950,000	Puntledge
Coho	Puntledge	84	egg	1,200,000	May 1986	1,000,000	Puntledge
Coho	Puntledge	84	egg	3,000,000	June 1985	2,700,000	Comox Lake watershed
Coho	Puntledge	84	egg	800,000	June 1985	650,000	Tsolum River watershed
Coho	Tsolum	84	egg	50,000	May 1986	45,000	Headquarters Creek
Chum	Puntledge	84	egg	7,500,000	May 1985	7,200,000	Puntledge
Steelhead	winter run	84	fry	42,500	May 1985	42,000	Puntledge
Cutthroat	Puntledge	84	fry	1,750	May 1985	1,700	Puntledge
Quinsam River Hatchery							
Pink	Quinsam	84	egg	5,100,000	March 1985	3,000,000	Quinsam
						2,000,000	Campbell
Coho	Quinsam	84	egg	3,300,000	Sept. 1985	100,000	Quinsam
					May 1986	1,600,000	Quinsam
Chinook	Quinsam	84	egg	3,800,000	June 1985	3,000,000	Quinsam
Steelhead	Quinsam	84	smolt	21,364	May 1985	21,000	Quinsam
Coho	Quinsam	83	smolt	1,950,000	May 1985	1,900,000	Quinsam

* Includes facilities constructed prior to SEP.

N/A means "not available."

[1] Reared at Cobble Hill quarry.

[2] Reared at Cobble Hill quarry.

[3] Reared at Cowichan net pens.

[4] Surplus steelhead for lake stocking.

Table 22

East Coast Vancouver Island SEP Facilities: Surplus Sales 1984*

Species	Number Eggs/Juv.	Stage	Dis-position	Value ($)	Surplus Adult Sales (kg)	Value ($)
Big Qualicum Project						
Chinook	2,500	egg	sales	25.00	614 pieces to Qualicum Indian Band	
Chinook	45,591	egg	research	--	--	--
Chinook	496,000	egg	sales	6,944.00	--	--
Coho	189,080	egg	research	--	34,367 pieces to Qualicum Band	
Coho	30,000	egg	research	--		
Chum	--	egg	--	--	1,542 pieces to Qualicum Band	
Puntledge River Hatchery						
Coho	0	--	--	--	16,785.09	26,910.52
Chum	0	--	--	--	4,196.24	167.85
Quinsam River Hatchery						
Chinook	2,400	egg	sales	24.00	--	--
Chinook	10,000	egg	research	--	--	--
Coho	54,100	egg	research	--	28,539.00 +100 jacks for research	23,148.50
Pink	52,800	egg	research	--	--	--
Mixed[1]	--	--	--	--	20,042.00	601.26

* Includes facilities constructed prior to SEP.

[1] Returning species sold together.

Table 23

East Coast Vancouver Island SEP Facilities: Escapement to Facility 1984*

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked (male and female)
		male	female	
Cowichan Band Project				
Chinook	--	63	74	N/A
Coho	--	96	148	N/A
Chum	--	186	402	N/A
Vancouver Island Hatchery				
There are no escapements to the hatchery since stocks are outplanted to sites away from the rearing facilities.				
Nanaimo Community Development Project				
Chinook (spring run)	captured brood stock	34	32	2
Chinook (fall run)	captured brood stock	57	62	44
Coho (Nanaimo R.)	captured brood stock	129	101	30
Coho (Millstone)	captured brood	76	55	--
Little Qualicum Project				
Not available at time of printing.				
Big Qualicum Project				
Coho (jack)	8,653	0	0	2
Coho (adult)	44,777	1,750	2,594	37
Chinook (jack)	1,915	0	0	3
Chinook (adult)	5,710	1,167	1,338	17
Chum	64,350 (river)	0	0	--
Chum	27,940 (SPCH2)	0	0	--
Puntledge River Hatchery				
Chinook (summer run)	859	230	285	20
Chinook (fall run)	173	8	4	42
Coho	46,461	2,967	3,029	5
Chum	35,000	8,000	4,291	2
Pink	50	0	0	--
Quinsam River Hatchery				
Pink	9,265	4,765	3,979	5
Coho (adult)	15,439	1,450	1,700	25
Coho (jack)	15,690	15,689	1	25
Chinook	1,677	590	650	18

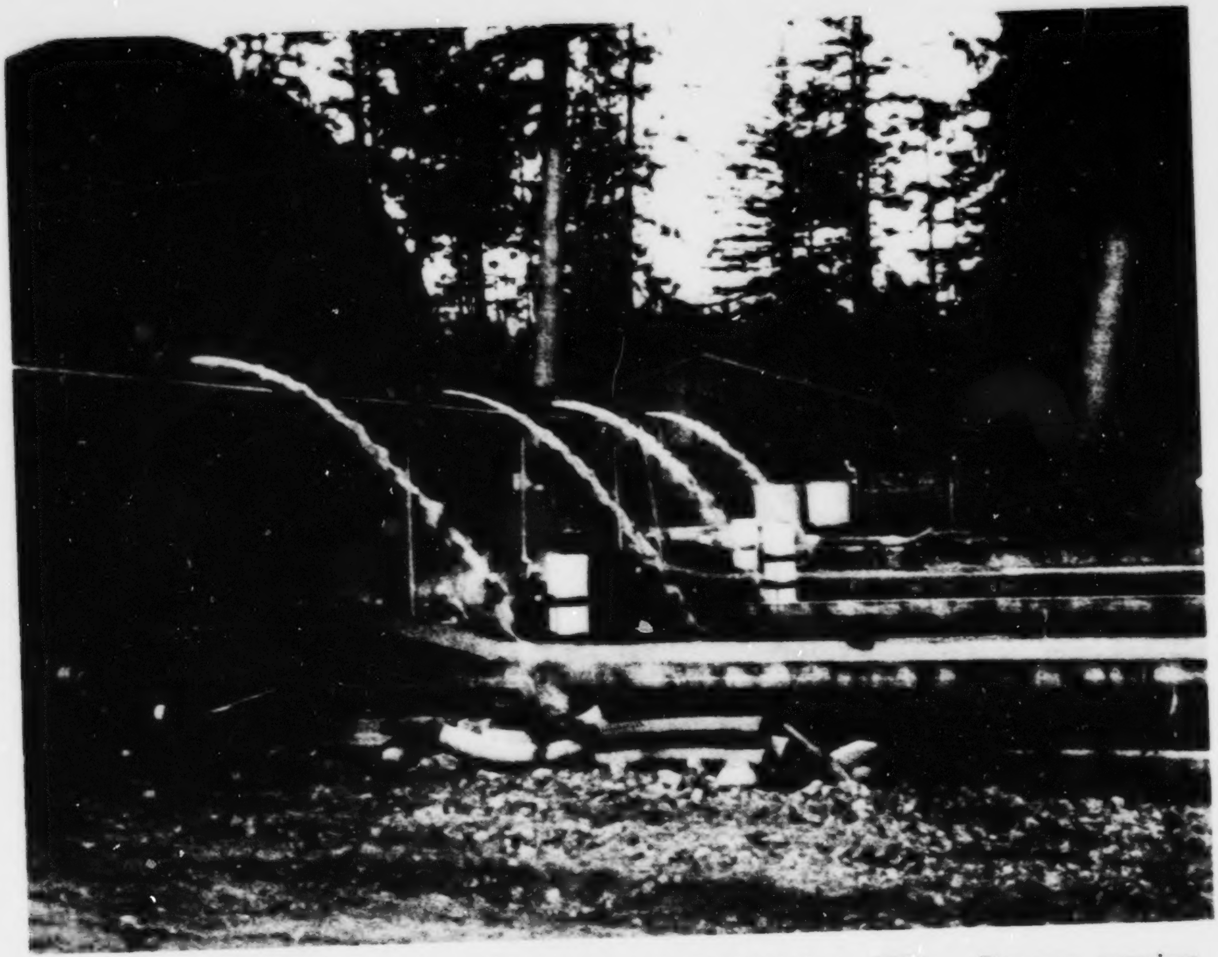
* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 24

East Coast Vancouver Island SEP Facilities*: Adult Production

	Expected Production from 1984 Releases			At Full Production		
Species	Total Adult Production	Years of Return	Contribution to Fisheries (pieces)	Total Adult (pieces)	Contribution to Fisheries (pieces)	Contribution to Fisheries (lbs)
Cowichan Bend Project						
Not available at time of printing.						
Vancouver Island Hatchery						
Cutthroat	4,170	1985-88	2,085	—	—	—
Steelhead	3,200	1986-89	1,600	—	—	—
Chemainus River Hatchery						
Chinook	5,687	1985-88	4,011	4,000	2,815	22,858
Coho	563	1986-87	334	1,000	557	2,712
Nanaimo Community Development Project						
Not available at time of printing.						
Little Qualicum Project						
Chinook	37,476	1985-88	26,389	45,000	31,667	257,150
Steelhead	1,479	1985-90	750	1,200	600	6,180
Chum	171,046	1986-88	75,240	367,000	161,480	1,883,180
Coho	no releases in 1984			5,400	3,010	14,646
Big Qualicum Project						
Chinook	95,309	1985-88	67,065	203,000	142,855	1,160,031
Coho	188,204	1985-86	104,899	340,000	189,509	922,166
Steelhead	2,674	1986-90	1,350	2,000	1,000	10,300
Chum	368,989	1986-88	162,360	386,000	169,840	1,980,674
Cutthroat	no releases in 1984			500	335	168
Puntledge River Hatchery						
Chinook	23,945	1985-88	16,819	151,000	106,262	862,880
Coho	204,468	1985-87	113,984	149,000	83,050	404,126
Chum	130,127	1986-88	57,244	120,000	52,800	615,754
Pink	18,818	1985	11,280	10,000	6,000	24,100
Steelhead	1,214	1986-90	600	4,000	2,000	20,600
Cutthroat	no releases in 1984			800	536	268
Quinsam River Hatchery						
Chinook	43,406	1985-88	30,542	90,000	63,335	514,300
Coho	178,539	1985-87	99,492	166,000	92,525	450,234
Pink	173,686	1985	104,220	134,450	80,670	391,250
Steelhead	796	1986-90	400	2,000	1,000	10,300

* Includes facilities constructed prior to SEP.



This hatchery building at Snootli Creek was completed in 1984. The new pumping system was tested at the rearing ponds and the new well yields 13.6 L/s which brings the total groundwater supply to 88 L/s at the facility.

Central Coast

Oweekeno Community Development Project

The Oweekeno Salmonid Enhancement Program (OSEP) is operated by the Oweekeno Band at the head of Rivers Inlet, 500 kilometres north of Vancouver. There is a three-year agreement with the Local Employment Assistance Program (LEAP) to jointly fund the development of a salmonid enhancement project with the Community Economic Development Program of SEP. It was in its second year in 1984. The Oweekeno CEDP contract provides for wages, overhead, training and travel costs for the project manager and for limited operational costs. The employment project provides training funds for two additional crew and for development and operational costs.

Accomplishments in 1984 include the completion of a sea pen float and the subsequent rearing of 28,000 Wannock River chinook (1983 brood) to release in early July at 4 - 5 grams. These fish were initially incubated and reared at the Snootli Creek facility then transferred by air to Oweekeno project in early July. While the lake was high during the summer months a log salvaging operation was conducted on Owikeno Lake, securing several sections of quality logs for future milling. An efficient facility for Alaska-milling of these logs is now in place and provides a variety of lumber for constructing enhancement facilities. A second netpen float has been completed for the freshwater rearing and incubation site in the Wannock River.

In conjunction with the Snootli Creek hatchery staff, over 170,000 Wannock River chinook eggs were collected and flown to Snootli Creek for incubation and initial rearing. 50,000 of these fish will be returned to the Oweekeno sea pens for rearing until their release on July 1, 1985, while the balance will be coded-wire tagged and returned directly to the Wannock River in early June, 1985.

A total of 95,000 Wannock chum eggs were collected in November by the OSEP crew. These eggs are being incubated in three specially designed modifications of an "instream-floating" incubator. This new technology holds tremendous promise for remote projects such as Oweekeno's as it involves minimal capital investment and a simple but effective incubation system. The rearing of these chum eggs will occur in either the freshwater or marine sea pens depending on the spring salinities and will be released at a size of 1.2 g in early June, 1985.

Next year will see the initial development of this project completed. Further development and modifications to the instream incubators will occur pending the results of 1984/85 incubation. Intensive training will continue, both onsite and at Snootli Creek hatchery. 50,000 Wannock River chinook eggs will be collected and incubated onsite while additional eggs may again be collected for incubation and initial rearing at Snootli. Up to 250,000 Wannock River chum eggs will be collected, incubated and reared onsite.

An assessment of chinook utilization of the Wannock estuary and near shore habitat together with a downstream fry and smolt trapping program on the Wannock River should provide valuable information for fine tuning local enhancement strategies.

Contact: Colin Masson, Project
Coordinator, Special Projects
Division.

Bella Bella Hatchery

This hatchery is located on Campbell Island approximately 4 km south of Waglisla (formerly Bella Bella). The Heiltsuk Indian Band operates the chum and coho incubation, rearing and sea pen facility under contract with SEP. The purpose of the facility is to increase the availability of chum salmon for the native food and commercial fisheries and of coho for an increasingly popular sport fishery. Additional benefits accrue to the community through increased participation in the management and enhancement of the resource, increased employment and an opportunity to train some of its members in a new technology with the potential for long-term benefits.

The year 1984 marked the turning point in the development, operation, and success of this facility. Unnoticed water quality problems have seriously jeopardized production from this facility in the past. This year, a major effort was directed toward developing appropriate incubation methods and water treatment that would improve the survival of eggs especially to eyed egg stage. To this end, and with the direction of the biological and engineering support group of Small Projects, a number of modifications took place. First, the lake intake was raised for the first time since 1979. It was cleaned, modified and replaced at a higher level off the bottom. Second, the incubation room and incubators were modified and limestone added to some of the containers to buffer the acidic water.

In the end, five styles of incubators were used. Each had a control, to permit assessing the success of each type. The results to date are encouraging: approximately 90 percent survival to eyed egg stage in the experimental incubation, versus 20 to 30 percent in the control incubators. This is a huge difference when compared with 1983 when approximately 1.8 million chum eggs were incubated and only 81,000 fish were released in June 1984.

Other releases in 1984 included approximately 13,000 hatchery and 800 salvaged fry to McLoughlin Lake at approximately 8.5g average weight. In addition, 15,000 Kajusdis Creek sockeye were returned to the headwaters of the natal stream in April 1984 at 0.5g average weight.

In 1984, for the first time, all of the chum brood stock was collected from McLoughlin Creek. An estimated 4,500 adults returned from fry releases of 525,000 and 150,000 in 1981 and 1980 respectively. The age composition was determined to be 92 percent three-year-old and 8 percent four-year-old fish. This represents a total escapement of approximately 0.8 percent of the fry released. A total of 1.46 million chum eggs were collected.

Coho brood stock was collected from nearby Kakushdish Creek and from McLoughlin Creek. The total coho egg collection was 25,074 and 7,500 eggs respectively from each system.

Other activities carried out this year included a downstream monitoring program to assess relative species abundance and migration timing and monitoring of McLoughlin Lake, Creek and estuary. Rearing capacity was increased by 40,000 fish (5g size) with the addition of two rearing troughs. The building was repainted and an alarm system was installed to alert workers to reduced flows, fire or vandalism. The fry transportation pipeline installed last year worked very well to transfer the chum approximately 40 metres from the hatchery to the sea pens. With the aid of a job creation program the flow control weir started in 1983 was completed but it still requires some repair and modification. A tremendous improvement was made to the operation of the facility with phase one of the road and hydro installation. Although not complete, the road is driveable and the facility can be serviced by land for the first time now. The road and hydro completion is planned for 1985. The hatchery building was wired in 1984 to accommodate this development next year.

In 1984, the Heiltsuk Indian Band secured a job creation contract to remove obstacles to fish passage in Areas 6, 7, and 8, to repair the Kakushdish fishway and complete the flow control weir at McLoughlin Creek. This project is working very well to date, with the support and encouragement of the local fisheries office. Reconnaissance of future enhancement opportunities is also being investigated by Band/job creation contract personnel.

The regular staff received onsite training in data collection and project management, downstream trapping, report preparation and financial management.

Work planned for 1985 includes the construction of new sea pens and freshwater delivery systems, modification and repair of the river intake and flow control weir, installation of a water buffering device plus completion of the incubation modifications and the road and hydro installation.

Ongoing activities include downstream trapping, monitoring, rearing, brood stock collection, adult enumeration, incubation and report preparation.

Contact: Maurice Boisvert, Project
Coordinator, Special Projects
Division.

Hartley Bay Band Project

The Hartley Bay hatchery is located on Hartley Bay Creek, approximatley 130 km southeast of Prince Rupert. Funding for the project came from the Department of Fisheries and Oceans and Employment and Immigration programs. Three full-time and up to twelve part-time jobs were provided for approximately eight person-years of employment. CEDP courses were available to the full-time personnel as needed.

Construction of the hatchery including a 10 cm pipeline, Heath tray incubation, Capilano rearing troughs, a longhouse-style hatchery building and a warehouse was completed this year. In addition, boardwalks providing access to brood stock fishing sites and a trap for adult capture were completed. A boardwalk under construction will eventually provide access to the lake for net-pen rearing.

Thirty-six thousand coho fry from the 1983 brood year were released to an upper lake of Hartley Bay Creek, which is inaccessible to anadromous fish. Results in Alaska and preliminary results from 1982 Hartley Bay Creek coho indicates that survivals from this strategy will be good. The fry were released in two size groups, in June and July, to allow comparison of growth and survival rates.

The egg-take for 1984 was approximately 175,000. Brood stock was taken at the fence and with gillnets upstream. Eggs will be reared and released in the upper lake in a manner similar to that used for the 1983 brood year.

Plans for next year include addition of two more Capilano troughs and an increase of egg-takes to 200,000. Other lakes in the area will be considered for similar outplanting once the results from the first few years are evaluated.

Contact: Bruce Wright, Project
Coordinator, Special Projects
Division.

Klemtu Project

Klemtu is located approximatley 80 km north of Bella Bella on the central coast. The Kitasoo Indian Band operates this project under contract to SEP and Canada Employment and Immigration's LEAP program. 1984 was the last year of involvement for CEIC with the development facility.

CEIC has contributed the bulk of the monetary resources to train and employ personnel, and to build and develop the hatchery facility. DFO has provided support personnel to train Band staff and construct the facility as well as to assist with the completion of the first phase of the development.

The facility presently has a capacity to incubate 500,000 eggs and to rear half that number to a 5 g size. A small saltwater rearing float can accommodate 400,000 chum to 1 g size.

From the 159,000 chum eggs collected in 1983, approximatley 90,000 fry were released from the sea pens at 1.5g in May, 1984. Mortalities were attributtable to temporary interruption of the flow to some containers during incubation. Since no coho brood stock was available last year, the crews salvaged nearly 2,000 coho fry from Kitasoo Creek, reared them to approximately 7 g and released them to the upper reaches of the creek.

In 1984, hatchery staff successfully collected 413,388 chum and 17,028 coho eggs from Kitasoo Creek. Poor coho escapement and problems holding the adults resulted in a smaller egg-take than expected.

This year the incubation room was insulated and sheathed and heaters were installed to reduce the danger of freezing. Concrete was poured on the floor to reduce vibration and improve the drainage. Nine new vertical tray incubators and eight aluminum troughs were installed and plumbed. An alarm was connected to monitor any flow interruptions. A major logjam was removed above the hatchery site to facilitate access for spawning coho.

The crew visited thirteen hatchery facilities on Vancouver Island this year to complement the training they have received to date. On site training by the project advisor has included workshops dealing with report preparation, financial management, data management, fry transportation, downstream trapping, brood stock collection and incubation management. Some of the crew were also exposed to formal training in fish health, ponding, feeding and release.

The administration has been very successful in accessing a variety of job creation and training programs offered by CEIC. Crews hired on these programs helped with the hatchery development a great deal. Projects they were involved with this year included:

- construction of a ramp and covered porch on the hatchery building
- installation of six skylights over the rearing area
- construction of an access bridge over Mystery Creek
- development of new access trails to the upper reaches of Kitasoo Creek
- construction of a turnaround between the hatchery and the boardwalk
- construction of a deck to accommodate exterior rearing containers
- delivery of large equipment from the freight offloading dock to the hatchery site

Plans for 1985 include upgrading of the alarm system and the coho holding strategy as well as the addition of a water stripping device to help rid the water supply of compressed gases. Staff will operate a downstream trap in the spring and monitor Kitasoo and adjacent Mystery Creek throughout the year. They will rear emerging chum in the seapens to 1.5 g size and the coho to 5 g before release. Brood stock collection targets are 400,000 chum and 100,000 coho eggs.

Contact: Maurice Boisvert,
Project Coordinator,
Community Economic
Development Unit,
Special Projects Division.

Snootli Creek Hatchery

Snootli hatchery is located 15 km east of Bella Coola on the Central Coast. It is a Japanese-style chum hatchery with a projected capacity by 1986 of 7.2 million fry. The hatchery was completed in 1979 and is currently in the second consecutive year of exceeding its design capacity.

In 1984, approximately 7.9 million summer chum eggs were taken from four tributaries of the Bella Coola River system; Saloomt, Thorsen, Snootli and Fish Creek/Airport side channel. Another one million eggs were taken from the Necleetsconnay River which enters North Bentick Arm just northwest of the Bella Coola River.

Groups of eggs and alevins are incubated separately and fry are kept segregated until released to their native streams. Of the 8.4 million fry ponded, approximately one million were released as unfed fry (at 0.44 g) and another 550,000 as partially fed (at 0.6 g). Representative numbers from each group were marked for future assessment. The remaining 6 million fry will be reared at the facility to a 1g size prior to release.

All the Necleetsconnay fry are partially reared at the facility, then transferred to sea pens in the river estuary to be saltwater-reared to approximately 1.5 g average size. Seventy-five thousand of these fish were marked before transport to the sea pens.

The 1984 brood release is expected to contribute approximately 20,000 adults to the 1987 escapement and 160,000 to the 1988 return.

The hatchery contribution to the 1984 chum spawning escapement was estimated to be around 3,700 adults, over 30 percent of the total return. These contributed significantly to availability of donor stock for the 1984 egg-take. In 1985, hatchery fish (from 81/82 broods) should contribute approximately 45,000 to the total escapement.

Returns from all broods will contribute to the commercial, native and sport fisheries and will supplement river escapements. The hatchery contribution to the commercial fishery during 1984 was estimated at over 12,000 chum salmon.

The Atnarko chinook program was expanded this year to an egg-take of one million eggs and a projected 931,000 fry release. The coho program was continued in 1984 and tentative plans are being made for the construction of an earthen rearing channel which would increase hatchery capacity to facilitate a release of 600,000 14g smolts. Currently, approximately 150,000 fry are partially reared at the facility then offsite reared to 3g size at release. They are planted in numerous streams throughout the valley where trapping data has been collected to determine stream carrying capacity and to minimize species competition.

The Wannock River pilot egg-take continued in 1984. Fry groups will be partially reared and CWT marked at the hatchery before being transported back to the Wannock River for release (100,000) or extended rearing in sea pens (30,000). This program is coordinated to include participation from the Owikeeno Band SEP members who will once again operate the sea pen facility.

The hatchery is in its fourth year of a cooperative effort with the Fish and Wildlife Branch in steelhead fry-stocking of the Saloomt River. In 1985, the first returns from fry and smolts released in 1981-1983 are expected. Adults produced from enhancement will contribute to the native food and sport fishery as well as supplementing overall escapements to the Bella Coola River system.

In 1984, experiments were initiated to assess different gravel sizes and depths, as well as alevin densities in keeper channels. Initial assessment of gravel size indicates that 50.8 mm gravel gives favorable results under normal alevin densities, while larger gravel (76.2+) can result in crowding, both at the top and bottom ends of the keeper. Deeper gravel layers did not result in significant mortality, but are not favored due to the extra work required in getting fry out of the keepers and in subsequent cleaning.

In 1984, the staff of Snootli hatchery participated extensively in community and school projects. Staff assisted and advised a community group which procured 26,000 fall chum eggs from the Bella Coola system. They are currently being incubated in a gravel deep-substrate incubation box. The same group participated in procuring 20,000 coho eggs from the Bella Coola system which are being incubated in Heath stack incubators. The hatchery provided assistance in construction, placement and care of a school incubation box where 900 eyed coho eggs from the facility will be incubated then partially reared by students before being released. It is felt that this involvement has had a significant effect in increasing public awareness and support of the SEP program in the community.

In 1984, an additional well was drilled, yielding 13.6 L/s. Two existing wells were redeveloped to restore flows to their original capacity. The total groundwater now available from six wells is approximately 88 L/s. In addition, groundwater supply lines and aeration facilities were installed. Eighteen Heath stack incubators were moved from the keeper Quonset hut and set up in the new incubation building which was finished in 1984. Aeration towers were constructed for all incubation and rearing units.

In 1985, it is proposed to upgrade the hatchery electrical service and modify both the groundwater and surface water systems.

Contact: Russ Hilland, Stock Enhancement Officer, Enhancement Operations; Otto Rapp, Sr. Project Engineer, Engineering.

Kitimat Hatchery

The hatchery is located on the Kitimat River near Kitimat, 300 m downstream from the Eurocan Pulp and Paper Co. mill.

In 1984 (the first year of operation), full production for chinook (2,000,000 smolts), coho (600,000 smolts), and steelhead (70,000 smolts) was achieved. Also, 2.5 million chum fry (25 percent of production) were being reared.

The hatchery is a central facility incorporating many stocks that are reared in discrete units and taken back to their stream of origin by tank truck and helicopter for release.

Under an agreement with the Eurocan Pulp and Paper Co., the mill supplies 5000 litres/min. of 40°C waste water from their condenser system. This water is mixed with hatchery-pumped water for use in rearing fish, de-icing the hatchery intake and heating the 3,250 m^2 hatchery building. This facet of operation represents a unique example of co-operation between a government agency and industry.

The facility had only been operating for six months when the need for an additional source of clean water, for supplementing the inadequate filtered water supply, became a high priority for 1984. Consequently, three new production wells were drilled adjacent to the Kitimat River on the hatchery site.

An exploratory 300 mm diameter well, drilled near the hatchery's river intake in March, led to the discovery of a strong aquifer with excellent capacity and quality groundwater. This particular water well has a capacity of 2,955 L/min. which almost equals the combined output of the two existing wells.

Subsequently, two additional 300 mm diameter groundwater wells were established in December. These latest wells (with capacities of 4,350 and 5,455 litres per minute) outperformed all others drilled thus far.

Given that only the two existing small wells were found previously to contain suitable groundwater within the Kitimat Valley, the 1984 drilling program was indeed a major success.

Returns from the 1979 brood release of chinook smolts reared at the Kitimat pilot project contributed greatly to reaching full production at the new hatchery. Of the 300 female chinook captured in 1984 in the Kitimat River for egg-take purposes, 50 percent (150) were marked hatchery fish. The average weight of these fish was 16 kg. Preliminary indications show that the survival rate from this small (34,000) release may be as high as 10 percent.

Hatchery releases and subsequent returns will contribute a total stock of 65,000 chinook, 60,000 coho, 2,000 steelhead and 150,000 chum to the fishery and the spawning grounds.

In the Kitimat area, sport fishing is by far the most actively pursued recreational activity. Consequently, the main area of interest in the hatchery program is from a sport fishing point of view. In keeping with this, the hatchery now acts as a Head Depot. Persons bringing in heads from adiposed-clipped fish are given pamphlets and literature explaining the enhancement program and souvenir buttons and pins. As well, they are given a tour of the facility.

Contact: Dave McNeil, Stock
Enhancement Officer,
Enhancement Operations;
Ed Woo, Project Engineer,
Engineering.

Central Coast Reconnaissance/Feasibility

Bioengineering reconnaissance surveys were conducted by helicopter in Statistical Areas 8-10 in April 1984. These surveys were undertaken to add missing information on potential opportunities for salmonid enhancement projects, as identified in the 1983 preliminary report by the Enhancement Opportunities Subcommittee. In particular, South Bentinck Arm, Bella Coola, Owikeno, Rivers Inlet, Moses-Dravey Inlet and Smith Inlet systems were examined. Preliminary work such as land status, flood probability, etc. has been started for the Atnarko spawning channel as requested by the Area 8 Management Meeting. To date, intake locations have been identified on two sites to be further researched in 1985.

Work has been completed on a preliminary design for a side channel in the Kwatna and Nekite Rivers.

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations; Jim Wild,
Implementation Engineer,
Engineering Division.

Gardner Canal Reconnaissance

Adult biobaseline surveys of the Kemano, Kitlope, Tezwa and Kowesas systems were reported on in 1981 and 1982. Complementary studies of juvenile salmon in the Gardner Canal area had been deferred until details of the Alcan Kemano Completion Project were known. These juvenile biobaseline studies proceeded in 1984 under a contract to Aquatic Resources Ltd. During 1984, the contractor examined juvenile migrations and estuarine rearing in the Kemano area, and surveyed adult spawners in the Kemano, Kitlope, Kowesas and Tezwa systems; a report will be available available in 1985.

Contact: Bruce Shepherd,
New Projects Coordinator,
Enhancement Operations.

Smith Inlet Reconnaissance

The Nekite River, which is located at the head of Smith Inlet, was identified previous surveys as having excellent potential for a combined spawning channel/hatchery facility, possibly serving salmon stocks from the Nekite River, and from the Walkum and Takush systems located along Smith Inlet.

Envirocon Ltd. undertook baseline spawner surveys of these three systems in 1984; complementary studies of juvenile salmonids will be implemented in 1985. The contractor's report on the adult work will be available in 1985.

Contact: Bruce Shepherd,
New Projects Coordinator,
Enhancement Operations.

South Bentinck Arm Reconnaissance

Field Services staff identified the possibility of enhancing South Bentinck Arm stocks, in order to expand the North Bentinck Arm (Bella Coola) terminal fishery into an area where interception of other passing stocks would be minimized. Funds originally allocated for Burke Channel juvenile studies were diverted to spawner surveys of the Taleomey, Noeick, Asseck and Larso Bay systems in 1984. These surveys were undertaken by Envirocon Ltd. and the contractor's report will be available in 1985. Complementary studies of juvenile salmonids will be implemented in 1985. It should be noted that the Noeick and Taleomey are turbid, glacial systems, and have been difficult to assess. In addition, the Noeick River suffered a major flood due to the collapse of a glacier and draining of Ape Lake into this system in the late fall of 1984. The impact on egg-to-fry survivals is anticipated to be severe. The results should be of considerable interest because biological surveys are seldom synchronized with such a major flood. This offers a unique opportunity for assessment of physical and biological impacts.

Contact: Bruce Shepherd,
New Projects Coordinator,
Enhancement Operations.

Provincial Status Report

Kitimat River Steelhead

The Kitimat River is located approximately 30 km due south of Terrace and flows for roughly 30 km adjacent to Highway 37 South. It then bisects the city of Kitimat near the head of Douglas Channel.

Historically, the Kitimat River supported an above-average winter steelhead run which over the years dwindled due to the combined effects of habitat degradation and overfishing. With construction of a new SEP-funded hatchery facility in Kitimat, the opportunity arose to bolster Kitimat steelhead stocks; basically to align them with angler demand and perhaps to reduce pressure on other nearby steelhead stocks. Beginning in 1983, 25,000 steelhead were to be reared to smolt size and then released in predetermined sites on the river. However, it became necessary to review plans for Kitimat when it became apparent that the new hatchery facility would not be ready in time for the 1983 brood year. Therefore, the 1983 project was cancelled.

In 1984, 18 brood females and 11 brood males were collected during the period April 16 to May 2. Approximately 72,000 eggs were collected and placed in Heath trays in the newly-opened Kitimat hatchery.

Since space was not a problem at the hatchery, the decision was made early to go to complete smolt production. The initial plan was to raise only 25,000 smolts and release the remainder as fry in the fall of 1984.

During mid-summer 1984, an assessment of habitat (for future fry releases, if necessary) and smolt release sites was carried out by means of electroshockers and minnow traps.

By the end of this period, Kitimat hatchery staff had reported good success in rearing steelhead with survival in excess of 90 percent. In 1985, it is anticipated that the target of 50,000 smolts will be easily attained. Assuming smolt-to-adult survival of between one and five percent, a return to the Kitimat during the years 1986-1988 of the 1984 brood should range from 600 to 3,000 adults.

Contact: Bill Chudyk, Fisheries
Biologist, Fisheries Branch,
Smithers.

Dean River Steelhead Creel Census

The Dean River supports one of North America's largest natural runs of summer steelhead and is internationally famous for its quality fishing.

Before 1960, little was known of the Dean's value as a sport fishery and industrial activities had not yet begun in the valley. However, more recently, roads associated with forest harvesting provided better access to the river. The improved access led to rapidly increasing angling pressure which threatened the high quality of the Dean fishery. In addition, intensive commercial fishing pressure along the migration route of Dean River steelhead has caused a decline in run size.

In response to this, the Fisheries Branch initiated a creel census that has been carried out annually since 1971. Information gathered during the study periods has been useful in managing the Dean River resource. General objectives of the creel census have been to determine the number and origin of anglers, angling success and methods, angler effort and success and distribution as well as life history characteristics of Dean River steelhead. Enforcement of fishing regulations and the Litter Act was undertaken in conjunction with the surveys.

A creel census was carried out on the Dean River between June 6 and September 5, 1984. Anglers were interviewed once or twice daily and information was collected on angler residence, tackle used, type of access, locations fished and number of fish caught. For each fish retained by an angler the following information was collected: date caught, location of capture, species, sex, nose-to-fork length, weight and maturity.

In addition to the creel census, information was obtained from two angling guides who operated on the Dean.

Results of the 1984 creel census indicate that the adult return to Dean River was one of the best on record. A total of 5,400 steelhead was caught by anglers, of which 5,100 were released and 300 retained. Approximately 3,500 angler days were accumulated by 400 camping anglers and 150 guided anglers. The catch per unit of effort was 1.65, considerably better than the average of .72 (steelhead caught per angler day).

The commercial fishery in tidal waters adjacent to the Dean River harvested 764 steelhead.

The creel census program will be continued during the summer of 1985. In addition, preliminary juvenile assessment and habitat capability studies will be carried out in July and August.

Contact: Tom Wilkinson, Fisheries
Technician, Fisheries Branch,
Williams Lake.

Atnarko/Bella Coola Steelhead Enhancement

During the 1970s, returns of steelhead to the Bella Coola system declined considerably, mainly due to overharvesting by the sport and Native fisheries as well as habitat degradation. Starting in 1981, several enhancement projects were undertaken on the system to increase steelhead production and thereby restore angling activity to former levels.

The primary enhancement project on the Bella Coola system involves a six-year headwater stocking program on the Salloomt River. The objective of the program is to establish steelhead in previously unused rearing habitat above a set of impassable falls. The barrier will eventually be removed thus allowing the population to become self perpetuating. In 1981, 79,000 fry were released and in 1982, 49,000 fry were liberated to the Salloomt River. In 1983, 61,500 fry were released to the Salloomt River, 37,000 to the Atnarko and 36,300 fry were distributed among six other Bella Coola tributaries and Hotnarko Lake (15,000).

In 1984, the fourth steelhead fry release was undertaken on the Salloomt River. Brood stock was obtained from the Bella Coola River, November to February. Adult holding, incubation and rearing were carried out at Snootli Creek hatchery.

Fry releases were also undertaken on two other tributaries of the Bella Coola system as well as Hotnarko Lake.

During a period from March to June, 1984, 133,000 eggs were taken from Bella Coola River brood stock. Approximately 104,000 unfed steelhead fry were released into Bella Coola tributaries (Salloomt R., 52,000; Atnarko, 32,000; Hotnarko Lake, 10,000; Noosgulch R., 10,000). The expected return of adults (1989-90) is 1,000 - 1,200 adults.

Work to be done in 1985 includes:
fry stocking
Salloomt River (60,000)
Atnarko River (40,000)
Noosgulch River (20,000)
- possible removal of Salloomt River falls
- habitat capability and juvenile assessment of Atnarko River
- continued assessment of growth and survival of Salloomt River fry
- Camera Channel spawning platform assessment
- steelhead reconnaissance on South Bentinck tributaries.

Contact: Tom Wilkinson, Fisheries Technician, Fisheries Branch, Williams Lake.

Job Creation Projects

Hartley Bay

A job creation crew constructed a boardwalk-style road, a warehouse and assisted in the completion of the hatchery.

Tastsquan Creek

The stream banks were stabilized and a spawning platform was put in which should accommodate twenty pairs of salmon.

A map of the creek was made and spawners were enumerated.

The crew also built an incubation box, and, after training at Snootli hatchery, took 46,000 chum eggs. Of these 26,000 were placed in the incubation box and 20,000 went to Snootli hatchery.

A flood on Tastsquan Creek in September destroyed the incubation box and all eggs were lost. The box was reconstructed and the 20,000 eggs incubating at Snootli hatchery were placed in it.

After the flood, 12,000 coho fry and a few steelhead fry in the creek were salvaged.

Bella Bella

The job creation crew assisted in the capture of brood stock for the Bella Bella hatchery, assisted in egg-takes, cleaned and sorted gravel, installed a flow control weir, constructed a net pen float and repaired the hatchery boardwalk.

The crew also cleared streams and provided spawner escapement estimates for 26 streams in the Bella Bella area.

Necleetsconnay River

Sea pen rearing facilities were built for Necleetsconnay River chum and 190,000 fry were transported to the pens from Snootli hatchery. All the fry escaped when an accumulation of ice in the river in January damaged the pens.

Contact: Chris deHrussoczy-Wirth, Head, Employment Development, Special Projects Division.

Table 25

Public Participation Projects

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Oona River	Oona River Community Association	25	4	incubation	coho	12,000	96	180

Contact: Barry Peters, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Tastquan Creek	Central Coast Fish Enhancement Society	15	1	incubation	chum	42,000	95	336

Contact: George Bates, SEP Community Advisor.

Table 26

Central Coast SEP Facilities*: Juvenile Releases 1984

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Oweekeno Community Development Project						
Not available at time of printing.						
Bella Bella Hatchery						
Not available at time of printing.						
Hartley Bay Band Project						
Not available at time of printing.						
Klemtu Project						
Not available at time of printing.						
Snootli Creek Hatchery						
Chinook	1983	Atnarko	563,164	31	86	3.0
Chinook	1983	Wannock	81,331	62	92	2.1
Coho	1983	Bella Coola	95,841	0	77	3.2
Steelhead	1984	Atnarko	106,439	0	80	0.3
Chum	1983	Fish/Air	1,722,108	0	92	0.8
Chum	1983	Necleetsconnay	1,329,588	6	92	0.9
Chum	1983	Snootli	1,441,018	15	92	0.8
Chum	1983	Salloomt	2,013,966	5	92	1.0
Chum	1983	Thorsen/ Nuhaulk	935,827	0	92	0.9
Kitimat Hatchery						
Chinook	1983	Kitimat	914,280	9	88	6.4
Chinook	1983	Kildala	111,600	43	94	6.0
Chinook	1983	Dala	53,295	0	97	6.1
Chinook	1983	Hirsch	57,995	92	97	5.2

* Includes facilities constructed prior to SEP.

Table 27

Central Coast SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Expected Release Site
Oweekeno Community Development Project							
Chum	Wannock R.	84	egg	95,000	June 1985	90,000	Rivers Inlet
Bella Bella Hatchery							
Chum	McLoughlin	84	alevin	1,463,717	May 1985	1,100,000	sea pens
Coho	Kajusdis/ McLoughlin	84	alevin	25,074	May 1986	20,000	sea pens
Hartley Bay Band Project							
Coho	Hartley Bay	84	egg	159,000	June 1985	150,000	Hartley Bay
Klemtu Project							
Chum	Kitasoo R.	84	alevin	413,388	May 1985	400,000	sea pens
Coho	Kitasoo R.	84	alevin	17,028	Sept. 1985	15,000	Kitasoo Lake
Snootli Creek Hatchery							
Chum	Snootli	84	alevin	1,954,986	Feb. 1985	1,100,000	Snootli
					Mar. 1985	850,000	Snootli
Chum	Thorsen	84	alevin	957,327	Mar. 1985	951,000	Thorsen
Chum	Fish/Air	84	alevin	2,546,930	Feb. 1985	486,828	Fish/Air
					Mar. 1985	2,033,100	Fish/Air
Chum	Saloomt	84	alevin	1,914,441	Mar. 1985	1,907,400	Saloomt
Chum	Necleetsconnay	84	alevin	1,058,952	Feb.- Mar. '85	1,055,952	Necleetsconnay
Chinook	Atnarko	84	alevin	933,256	June 1985	931,000	Atnarko
Chinook	Wannock	84	egg	139,475	June 1985	138,000	Wannock
Coho	Bella Coola	84	egg	148,732	June 1985	141,000	28 release sites in Bella Coola tributaries
Steelhead	Atnarko	84	adult	Fifty-one adults on hand should produce 120,000 fry for release in July-August 1985.			

Table 27 (Cont'd)

Central Coast SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Site
Kitimat Hatchery							
Chinook	Upper Kitimat	84	fry	115,000	May 1985	113,600	Upper Kitimat
Chinook	Lower Kitimat	84	fry	1,670,000	May 1985	1,650,000	Lower Kitimat
Chinook	Hirsch Creek	84	fry	66,000	May 1985	65,000	Hirsch Creek
Chinook	Dala River	84	fry	44,000	May 1985	43,000	Dala River
Chinook	Kildala River	84	fry	150,000	May 1985	149,000	Kildala River
Coho	Kitimat R.	83	yearling	599,000	May-June '85	598,000	Kitimat River
Coho	Kitimat R.	84	fry	852,000	May-June '86	845,000	Kitimat R.
Steelhead	Kitimat R.	84	yearling	67,300	June 1985	67,000	Kitimat R.
Chum	Humphrys Cr.	84	fry	412,000	April 1985	405,000	Humphrys Cr.
Chum	Lower Kitimat	84	fry	682,000	April 1985	645,000	Lower Kitimat
Chum	Hirsch Creek	84	fry	344,000	April 1985	340,000	Hirsch Creek
Chum	Dala River	84	fry	486,000	April 1985	475,000	Dala River
Chum	Kildala River	84	fry	389,000	April 1985	385,000	Kildala R.

* Includes facilities constructed prior to SEP.

Table 28

Central Coast SEP Facilities: Surplus Sales 1984*

Species	Number Eggs/Juv.	Stage	Dis-position	Value ($)	Surplus Adult Sales (kg)	Value ($)
Kitimat Hatchery						
Coho	10,000	eggs	research	--	--	--

* Includes facilities constructed prior to SEP.

Table 29

Central Coast SEP Facilities: Escapement to Facility 1984*

Species	Escapement to Facility	Spawned for Hatchery Stock male	Spawned for Hatchery Stock female	% Marked (male and female)
Bella Bella Hatchery				
Chum	4,500	500	636	0
Coho	--	12	16	0
Klemtu Project				
Chum	--	200	200	0
Coho	--	10	10	0
Snootli Creek Hatchery[1]				
Chum	3,400	449	681	1
Chum	1,150	204	341	3
Chum	4,400	506	853	10
Chum	1,258	403	687	9
Chum	1,600	278	410	0
Kitimat Hatchery				
Steelhead	--	10	13	N/A
Chinook				
Dala	--	9	7	N/A
Kildala	--	13	26	N/A
Up. Kitimat	--	8	18	--
Low. Kitimat	--	97	226	39
Hirsch Cr.	--	17	13	62
Chum				
Dala	--	151	223	N/A
Kildala	--	104	162	N/A
Kitimat	--	120	199	N/A
Mainstem				
Humphrys Cr.	--	145	176	N/A
Hirsch Cr.	--	107	145	N/A
Coho				
Kitimat	--	53	242	N/A

[1] Returns to area streams; Snootli, Thorsen/Nuhaulk, Fish/Air, Salloomt, Necleetsconnay.

* Includes facilities constructed prior to SEP.

N/A means "not available."

Table 30

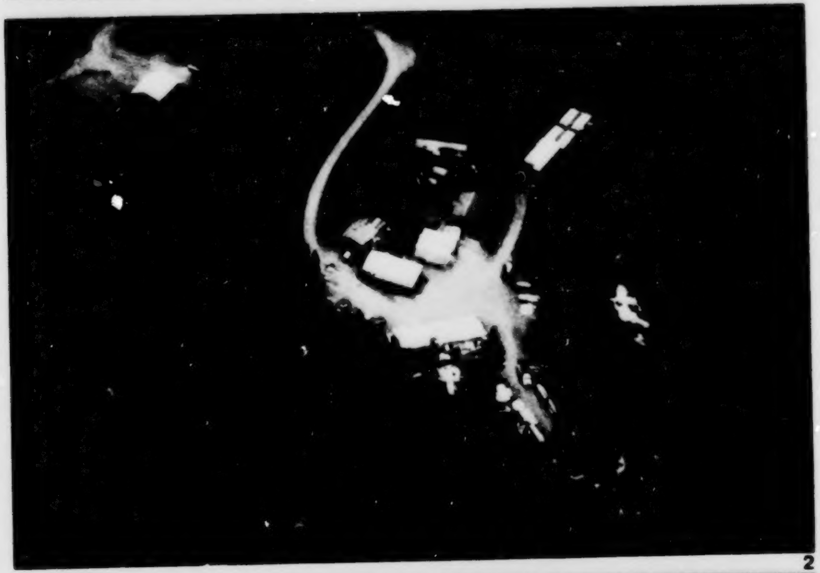
Central Coast SEP Facilities*: Adult Production

Species	Expected Production from 1984 Releases: Total Adult Production	Expected Production from 1984 Releases: Years of Return	Expected Production from 1984 Releases: Contribution to Fisheries (pieces)	At Full Production: Total Adult (pieces)	At Full Production: Contribution to Fisheries (pieces)	At Full Production: Contribution to Fisheries (lbs)
Oweekeno Community Development Project						
Not available at time of printing.						
Bella Bella Hatchery						
Not available at time of printing.						
Hartley Bay Band Project						
Not available at time of printing.						
Klemtu Project						
Not available at time of printing.						
Snootli Creek Hatchery						
Chinook	12,076	1985-88	10,181	14,080	6,315	70,150
Coho	1,438	1985-86	987	1,300	916	5,977
Steelhead	681	1987-91	350	900	450	4,635
Chum	148,850	1986-88	103,188	102,240	70,852	884,795
Kitimat Hatchery						
Chinook	34,115	1985-88	19,948	64,450	34,732	424,636
Chum	no releases in 1984			158,400	118,800	1,346,400
Coho	no releases in 1984			60,700	36,420	235,819
Steelhead	no releases in 1984			1,000	500	5,150

* Includes facilities constructed prior to SEP.

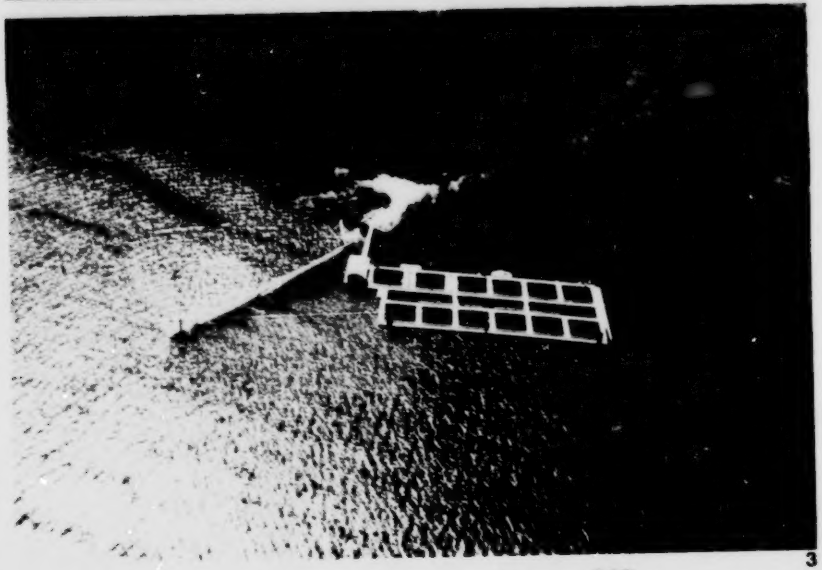
1

Enhancement activities in the Queen Charlotte Islands are focused on Cumshewa Inlet.



2

Pallant Creek hatchery, a modified Japanese-style chum facility, is now operating at its production capacity of 10 million eggs.



3

Extensive studies were undertaken at Pallant Creek in 1984 to determine the best time and size for release from these sea pens.

Queen Charlotte Islands

Pallant Creek Hatchery

Pallant Creek hatchery is located 48 km south of Sandspit, on the Queen Charlotte Islands. The hatchery is a modified Japanese-style chum facility with a capacity of 10 million eggs. The facility was constructed in 1978 and is now operating at full production.

Chum salmon are incubated and initially reared at the facility, then transferred to sea pens for final rearing and release. Coho from Pallant Creek are incubated and reared in fresh water then outplanted throughout the watershed as fed fry in early June.

In 1984, an extensive chum fry marking program was carried out to determine the optimum time and size of release from the sea pens. Studies were also carried out to determine the optimum period of fresh water rearing before transfer to salt water. The marking program will be repeated in 1985, and the first returns of the 1984 release will be in 1987. Future activities with coho will include extended rearing of juveniles and outplants to nearby systems.

In September 1984, the first commercial net fishery for hatchery chum salmon took place in Cumshewa Inlet. Almost 90 percent of the 47,000 chum taken were of hatchery origin. This was from early production years when the hatchery was operating at one-third to one-half capacity.

Totals of 11.5 million chum eggs and 340,000 coho eggs were taken from Pallant Creek in 1984. Free-style (bulk) boxes were used to incubate the excess eggs. The chum fry will be transferred to the sea pens throughout March and early April, and released in April and May 1985. Coho will be released as fed fry in early June.

Contact: Pat Slobodzian,
Stock Enhancement Officer,
Enhancement Operations.

Mathers Creek Pilot Hatchery

The Mathers Creek pilot hatchery is located on Louise Island, 10 km east of Beattie Anchorage. Construction and egg-takes began in 1980. Except for the 1983 brood year, Mathers chum eggs have been incubated at the Pallant Creek facility and returned to Mathers for rearing, imprinting and release. Good results have been obtained from incubation and rearing on Mathers Creek surface and groundwater.

In spring 1984, the Mathers facility released 615,000 chum fry. Eggs were not collected in fall 1984 because the adult collection fence was undergoing major repairs which could not be completed in time for the fall program. The present plans are to continue the Mathers Creek pilot hatchery program, satelliting incubation at Pallant with rearing to take place at Mathers Creek. The data from the 1979-84 operation of the Mathers pilot hatchery is being reviewed; a report should be available in 1985.

Contact: Pat Slobodzian, Stock
Enhancement Officer,
Enhancement Operations.

Skidegate Community Development Program

The Skidegate Band employs three Band members on a full-time basis and four on a part-time basis. Funding this year came from SEP and two job creation programs.

Incubation and rearing facilities located on Slarkedus Creek, near the village of Skidegate, were used to raise 18,000 coho fry. The fry were released in Mission and Slarkedus Creeks at a size of 5 grams. The majority were released above a barrier on Mission Creek. They will be trapped next spring to assess growth and survival. Although survivals for the 1983 brood were excellent, similar numbers of 1984 brood did not survive because of problems arising during redevelopment of the domestic water supply. The situation has now been corrected and the Slarkedus site has been improved in the process.

On Tarundl Creek, 4 km west of Queen Charlotte City, an incubation box for chum was installed and 100,000 eggs were planted. Survival to the eyed stage was 75 percent. This box is to be the first of several, enabling the project to contribute significantly to the Skidegate Inlet chum fishery.

The Copper River, 10 km south of Sandspit, is the site of the other major ongoing activity for this project, the Copper River counting plate. A plate consisting of sheets of plywood painted white is used to enable a count of all sockeye migrating upstream. This information is then used to determine openings and closings for the food fishery.

In addition, a downstream fry trap is used to determine the timing and number of fry leaving the system.

Training continued to be an important part of the activities in 1984, with both courses and on-the-job training provided to the crew.

Contact: Bruce Wright, Project
Coordinator, Special
Projects Division.

Masset Community Development Project

The Masset Band project operates on the Yakoun River on Graham Island. There is a hatchery located on King Creek and there are net pens for rearing on Marie Lake. During 1984, 70,000 Yakoun River chinook fry and 10,000 Gold Creek sockeye were released. The 1983 brood year coho, 48,000 from King Creek and 18,000 from Gold Creek, are being held over the winter in Marie Lake for release in spring 1985.

Chinook egg-takes for 1984 totalled 50,000 and sockeye egg-takes totalled 110,000. The sockeye are incubated at a secondary incubation facility on Sheila Creek, a tributary of Gold Creek.

Plans for coho brood stock fishing were abandoned when excessive scouring caused by flooding and heavy wood debris washed out the hatchery intake. Following this incident, the chinook eggs were maintained through the use of pumps until the eyed stage when they were transferred to the Sheila Creek incubation site.

King Creek is no longer considered to be sufficiently stable or reliable to be the principal water supply for this project. As a result, plans for 1985 focus primarily on locating a new site which will allow economic and secure enhancement of the Yakoun River chinook stock.

Contact: Bruce Wright, Project
Coordinator, Special
Projects Division.

Job Creation Projects

Skidegate CEDP Project Support

The job creation crew prepared a site on Tarundl Creek for two incubation boxes, assisted in the chum brood stock collection and egg collection (100,000 eggs) and carried out a spawning ground survey of chum, coho and pink salmon.

On Slarkedus Creek, the crew fed and sampled 17,000 Slarkedus Creek coho fry and transplanted some of these fry to Mission Creek and Mission Creek lakes.

The incubation box and rearing troughs were moved further downstream due to reservoir construction.

The Slarkedus Creek brood stock collection resulted in 12,000 coho eggs and 15,000 coho eggs were collected from Miller Creek brood stock.

General site and facility improvements were made to the Slarkedus hatchery site.

The crew assisted with the monitoring of oxygen levels and water flows of the incubation boxes at Tarundl and Slarkedus Creeks. They also assisted in the bioreconnaissance of the Honna River and Tarundl, Miller and Slarkedus Creeks for the purposes of looking for possible hatchery water sources and barriers to adult migration.

Masset CEDP Support

The job creation crew helped in many of the operational and site maintenance duties, such as cleaning and changing the net pens at Marie Lake, helping to install a water line, assisting hatchery staff with chinook brood stock capture in the Yakoun River, assisting with egg-takes and water quality monitoring.

Pallant Creek Hatchery

The job creation crew built a residence at the site, did some landscaping, cleaned hatchery rearing boxes and the counting fence and repaired nets.

Pallant Creek Coho-Cutthroat Interaction

The crew on this project sampled several Pallant Creek system streams and Mosquito Lake to study the interaction of hatchery-introduced coho with existing cutthroat stocks. The results of this study are available through the Prince Rupert office of DFO.

Contact: Chris deHrussoczy-Wirth,
Head, Employment Development,
Special Projects Division.

Table 31

Public Participation Projects

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Powrivco River	Frank Beban Logging	10	5	incubation	coho	5,500	22	66
Little Goose Creek	Western Forest Products	30	4	incubation	chum	41,500	95	332
					chum	40,000	96	320
Big Goose Creek					chum	15,000	96	120
Sewell Head Creek					coho	13,500	91	162
Sewell Inlet	Sewell Inlet School	20	1	assessment	Assists with Western Forest Products' projects.			
Gore Brook	Gore Brook Group	5	6	incubation	coho	8,150	98	98
Charlie Hardy Cr.	Queen Charlotte City School	50	3	incubation in school	coho	33	4	0
Rennie Creek	Port Clements Elementary	60	3	incubation in school	coho	40	20	0
Nadu Creek	Tahayghen Elementary School	25	5	incubation in school	coho	95	95	1
Nadu Creek	Northern Trollers Assn.	6	6	incubation, counting fence	coho	10,500 Some mortalities due to waterline freeze-up.	35	126
Lawn Creek	Northern Trollers Assn.	3	4	survey, fry trapping	coho	Small hatchery under construction.		
Wylie Creek	G.M. Dawson School	18	5	counting fence	coho chum	Counted 7 adult coho. Counted 2 adult chum.		
One Mile Creek	Port Clements Rod & Gun	10	3	incubation	coho	30,000 High mortality due to frozen waterline.	65	360

Contact: Tom Rutherford, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Sachs Creek Haans Creek	Fred Hawkshaw	6	2	incubation	coho	24,500	79	368
					pink	Released 25,000 as alevins due to freezing problems.		
					coho	48,500	93	582
Sachs Creek	A.L. Mathers School	25	2	incubation in school	coho	190	95	3
Pallant Creek	QCI Steelhead Society	10	2	tagging	steelhead	Tagged 55 adult steelhead.		
Jervis Creek	Jervis Crk. Residents	6	2	incubation	chum	3,200	91	26

Contact: Tom Rutherford, SEP Community Advisor.

Table 32

Queen Charlotte Islands SEP Facilities*: Juvenile Releases 1984

Pallant Creek Hatchery

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Coho	1983	Pallant	12,346	0	73	0.4
Coho	1983	Pallant	236,825	21	73	2.3
Chum	1983	Pallant	2,366,275	8	93	1.9
Chum	1983	Dear Bay	4,744,860	1	93	1.1
Chum	1983	Mathers	608,948	13	90	1.1
Pink	1983	Pallant	273,401	16	95	0.2
Pink	1983	Pallant	212,466	20	95	0.5

Mathers Creek Pilot Hatchery

Not available at time of printing.

Skidegate Community Development Program

Not available at time of printing.

Masset Community Development Project

Not available at time of printing.

* Includes facilities constructed prior to SEP.

Table 33

Queen Charlotte Islands SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Site
Pallant Creek Hatchery							
Chum	Pallant	84	alevin /fry	10,800,000	Apr.-May '85	all	Deer Bay
Coho	Pallant	84	alevin	340,000	June 1985	all	Pallant/ Mosquito Cr./ Braverman Cr.
Mathers Creek Pilot Hatchery							
No egg-take in fall 1984; collection fence undergoing major repairs.							
Skidegate Community Development Program							
Chum	Tarundl	84	egg	75,000	April 1985	70,000	Tarundl Cr.
Masset Community Development Project							
Chinook	Yakoun	84	egg	35,000	June 1985	35,000	Yakoun R.
Coho	King	83	fry	48,000	June 1985	48,000	King Cr.
Coho	Gold	83	fry	18,000	June 1985	18,000	Gold Cr.
Sockeye	Gold	84	egg	80,000	April 1985	80,000	Marie L.

* Includes facilities constructed prior to SEP.

Table 34

Queen Charlotte Islands SEP Facilities: Escapement to Facility 1984*

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked (male and female)
		male	female	
Pallant Creek Hatchery				
Chum	32,341	1,240	4,637	3
Pink	39,175	--	--	--
Coho	4,191	150	170	13
Sockeye	6	--	--	--

* Includes facilities constructed prior to SEP.

Table 35

Queen Charlotte Islands SEP Facilities: Adult Production*

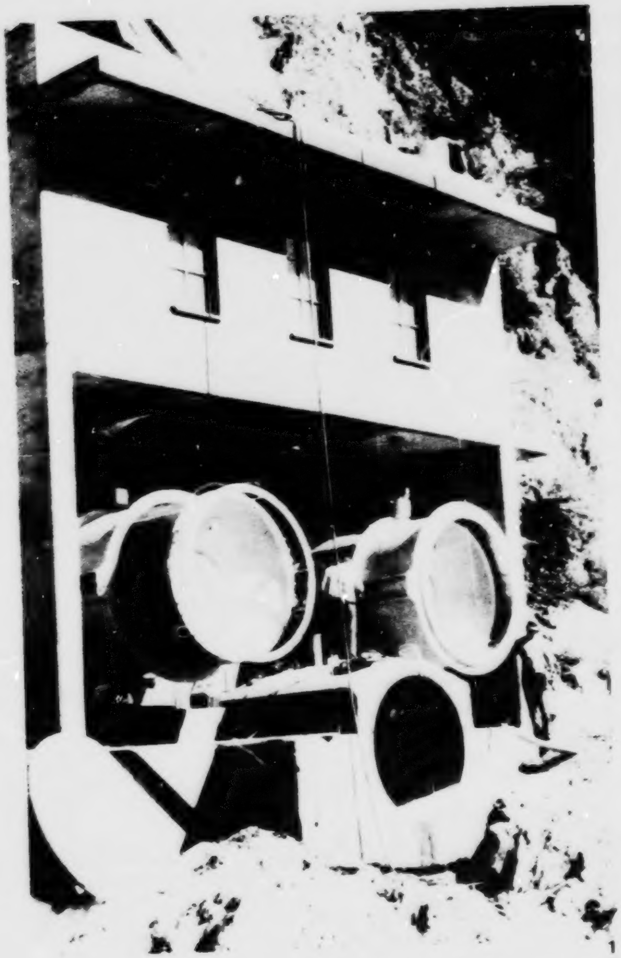
		Expected Production from 1984 Releases		At Full Production		
Species	Total Adult Production	Years of Return	Contribution to Fisheries (pieces)	Total Adult (pieces)	Contribution to Fisheries (pieces)	Contribution to Fisheries (lbs)
Pallant Creek Hatchery						
Coho	3,700	1985-86	1,658	3,200	1,434	9,480
Chum	178,126	1986-88	77,580	152,000	66,211	748,187
Pink	12,147	1985	6,776	(experimental rearing program)		

Mathers Creek Pilot Hatchery
Not available at time of printing.

Skidegate Community Development Program
Not available at time of printing.

Masset Community Development Project
Not available at time of printing.

* Includes facilities constructed prior to SEP.



1

Several improvements were made at Fulton River in 1984. These valves were repaired as part of the effort.

2

The steel tunnel at Fulton River was upgraded with the application of an epoxy coating.

North Coast

Kitsumkalum Pilot Hatchery

The Kitsumkalum Band, located near Terrace, has established a pilot facility at a groundwater site on the west bank of the Kitsumkalum River. Called "Site 11", it is approximately 10 km upstream from the confluence with the Skeena.

The pilot hatchery consists of a 50 cm pipeline, two stacks of Heath trays and two Capilano troughs.

Twenty three thousand Kitsumkalum chinook eggs were eyed at the Deep Creek hatchery, then transferred to Site 11 to test the pilot for chinook incubation and rearing. Assuming the pilot is successful, all enhancement of lower Kitsumkalum chinook will be done at this site. The site is also being used for 19,500 mainstem Kitsumkalum River coho. Again, these eggs were eyed at Deep Creek then transferred to Site 11.

The crew, consisting of two full-time and three part-time employees, has been responsible during the year for collecting information necessary for selecting the site, installing and developing the facilities, capturing the brood stock and monitoring the pilot hatchery. Funding has been provided by DFO, CEDP and job creation. Both formal training, at courses, and on-the-job training continued to be an important part of this project in 1984.

Plans for 1985 include trapping the outmigration of coho planted at the Site 11 beaver ponds, a development of the full potential of the Site 11 water supply and assessment of the pilot hatchery results. Favourable results will clear the way for development of a facility capable of incubating and rearing approximately 250,000 - 300,000 fry. Kitsumkalum chinook and coho stocks again be incubated and reared at this site.

Contact: Bruce Wright, Project
Coordinator, Special Projects
Division.

Terrace Kitsumkalum Salmonid Enhancement Society

The Society operates a hatchery on Deep Creek, a tributary of the Kitsumkalum River, just north of Terrace. The hatchery, built in 1983, has both groundwater and surface water supplies and has incubation and rearing capacity for 500,000 chinook salmon.

There are four full-time employees at the hatchery and, with the assistance of various job creation programs, as many as twelve part-time employees.

1983 brood year fry were released from the hatchery during 1984:

- 31,000 Kitsumkalum chinook
- 12,000 Copper River chinook
- 13,000 Kitsumkalum coho.

The Copper River chinook and some of the coho were released to controlled rearing areas for the winter and will be counted out in the spring.

The egg-takes for the 1984 brood year were:

- 257,000 Kitsumkalum River chinook
- 34,000 Copper River chinook
- 37,000 Cedar River chinook.

Survivals to eyed stage averaged 93 percent.

The Kitsumkalum chinook stock has been selected as a key stock for chinook management. As a result, society staff were responsible for a Petersen disc tag and recovery program before, during and after brood stock fishing to provide an estimate of escapement. Fry currently incubating at the hatchery will be coded-wire tagged to determine their distribution in the fishery.

Other activities during the year included completion of the hatchery building, bioreconnaissance of Deep Creek, trail and bridge construction around the hatchery site, armoring the dyke and construction of a boat shed. Work began on construction of a third pipeline which will provide water from Deep Creek to the rearing ponds. This will allow for substantially increased loading and alleviate problems of allocating flow between the hatchery and the rearing ponds. This project will be completed next year when instream work will not disturb incubating salmonids.

Plans for next year include continuation of enhancement for Kitsumkalum, Copper and Cedar chinook stocks. Zymacord chinook and Kitsumkalum steelhead will also be included in the plans for 1985. It is expected that the Kitsumkalum tagging study will also continue.

Contact: Bruce Wright, Project
Coordinator, Special Projects
Division.

Kalum Lake Beach Improvement

A pilot program on the Kitsumkalum River system near Terrace was initiated in 1984, to look at the feasibility of improving beach spawning habitat for a population of sockeye in Kalum Lake. This small population had declined in recent years, presumably from a combination of overexploitation and habitat degradation.

The beach spawning area was improved by the removal of the poor spawning substrate and the addition of graded gravel. A protective dyke was built to prevent deposition of silts and organic debris in the channel during high water periods in the lake.

Approximately half of this small stock of sockeye (about 100 adults) used the improved spawning beach in fall 1984. Site cleanup and assessment are planned for 1985 and it is hoped this technique will prove successful for increasing the productivity of this and other small stocks of sockeye in B.C.

Further work is planned in the north in 1985, focusing on improvement of groundwater spawning areas for coho, sockeye and chum and for providing groundwater rearing and over-wintering refuges for coho, chinook and steelhead.

Contact: Matthew Foy, Small Projects
Unit, Special Projects
Division.

Kispiox Band Project

The Kispiox project is located on the Kispiox reservation at the confluence of the Skeena and Kispiox Rivers. It is designed to increase the chinook stock, which is presently in a severely depressed state, and the coho stock of the Kispiox River. Steelhead production may be incorporation into future operations.

The facilities at the Kispiox hatchery allow for a flexible fish culture program including the present strategy of releasing coho and chinook fry at a variety of sizes and times to determine the optimal long term plan. October, 1984 saw release of 63,000 1983 brood coho fry. They were reared and coded-wire tagged prior to release. These fish were released in two groups, one group of 53,000 into the Kispiox mainstem and the balance into Penz Lake to study the overwintering survival of coho in small tributary lakes. This facility is presently incubating 108,000 1984 brood Kispiox coho eggs.

Valuable growth rate information has been gained by rearing 3,800 1983 brood chinook through 1984. These fish will be released in spring 1985, at an average weight of 50 g. As well, 207,000 1984 brood Kispiox eggs were collected in September and incubated with a survival rate greater than 95 percent. These fish will be reared on site, coded-wire tagged and 150,000 will be released at approximately 5 g in May 1985 and 50,000 will be released in September 1985, at approximately 15 g.

A downstream fry and smolt trap was operated on the Kispiox River to determine peak outmigration times for both chinook and coho. Some valuable information has been collected and the activity will be continued in 1985 to provide additional data.

1985 egg targets are dependent on run strength, but have tentatively been set at 200,000(+) chinook and 100,000 coho.

This project provides full-time employment for three staff and three more person years of part-time employment.

The hatchery is also utilized as a training facility by the CEDP training program.

Contact: Colin Masson, Project
Coordinator, Special Projects
Division.

Babine Facilities

The Babine Lake spawning channels and river flow control facilities were initiated as the Babine Lake Development Project in 1962. Earlier studies had indicated that the main basin of the lake could rear more sockeye fry than the rivers and streams flowing into the lake could produce. The project was designed to produce an additional 100 million fry to rear in the lake, and thus increase the size of the Skeena River sockeye run. At full capacity, the channels have exceeded the fry production targets, averaging 120 million fry annually. Computer models estimate the contribution to the adult escapement and Canadian commercial fisheries at 800,000 fish annually.

In 1984, for the third consecutive spring, an algae mat affected Channel 2 and was also observed for the first time in Channel 1 and the Pinkut channel. Efforts to remove the algae with increased flows were successful at Pinkut but not at Fulton. Consequently, survivals at the Fulton channels were considerably below normal. Production from the two facilities was 116 million sockeye fry, still above the original Babine Lake Development Project goal of 100 million.

Recent vandalism in the area has raised the fear that somebody might tamper with the control gates or valves at the projects, with disastrous consequences.

To avoid such problems, a radio alarm system was devised and installed at the regulating works. Breaking and entering or tampering with the control switches triggers the alarms. They ring at the site of the entry as well as in the camp area 4.8 km away.

Other 1984 activities included repairs to the cathodic protection system on the supply pipeline and installation of new aluminum panels for the enumeration fence.

- Fulton: additional effort was devoted to cleaning the gravel in channel 2. Studies of water quality, invertebrate populations, periphyton growth, and IHN virus were conducted.

- Pinkut: water quality and IHN virus studies were conducted and 48,500 adult sockeye were airlifted to spawning grounds above Pinkut falls after the lower river and channel were filled to capacity.

Contact: Stu Barnetson, Stock
Enhancement Officer,
Enhancement Operations;
Wai Leung, P. Eng., Sr.
Project Engineer,
Engineering.

Fort Babine Community Development Project

This CEDP developmental project is located at Fort Babine at the northern end of Babine Lake where the upper Babine River originates. The objectives of the project have been to continue with training in biotechnical and managerial skills required to operate an enhancement project and to continue the development of appropriate enhancement facilities.

In 1984, 30,000 Babine River (1983 brood) coho where successfully reared in an experimental floating trough. These fish now average 20g in size and are scheduled for release in spring 1985. Not only has the project gained valuable training in fish husbandry, but this new, cost-effective rearing technique has now been well proven.

A job creation contract again provided funds for hiring and training crew in several fisheries activities including assistance in the operations of the Babine River counting fence, and the Fort Babine rearing and brood stock collection activities.

Babine River chinook eggs (58,000) were taken from adults held at the counting fence. An innovative "moist" incubator was utilized with 95 percent survival until the eyed stage was reached. The eggs were then transferred into "instream cassettes." A total of 63,400 Babine River coho eggs were collected late in the year and are also incubating in the "instream cassettes."

In 1985, a second floating rearing trough will be constructed to allow for the extended rearing of both coho chinook and additional incubation capacity will be provided by more "instream cassettes." Part of the 1984 Babine chinook will be reared until a fall release at a 10g size and an equal group will be released following overwintering at an expected average size of 20g. The rearing strategy for the 1984 brood Babine coho will also include fall and spring release groups. The egg targets will be increased in 1985 to 100,000 coho and 100,000 chinook.

The next major development at this project will be construction of the Ft. Babine Fisheries Center planned for spring 1985. This building, funded jointly by CEIC, DFO, and Ft. Babine Enterprises, will serve as a laboratory, office area, equipment storage and maintenance area and will provide limited accommodation for support personnel.

The project appreciates the support provided by the Small Projects Unit of the Special Projects Division in providing the several innovative and successful techniques utilized at Ft. Babine.

Contact: Colin Masson, Project
Coordinator, Special Projects
Division.

Toboggan Creek Pilot (Smithers)

Located on Toboggan Creek, a tributary of the Bulkley River, this facility is situated approximately 10 km northwest of Smithers. The hatchery was funded jointly by the Fish and Wildlife Branch, a job creation program and the Small Projects Unit of SEP. It is designed to rear 250,000 steelhead fry, 150,000 chinook smolts and 100,000 coho smolts. At the present time, all steelhead fry destined for planting into Skeena River tributaries must be sent to the Abbotsford trout hatchery for incubation and rearing. It is hoped that the Toboggan Creek facility can assume this function in the near future. The hatchery may also be used as a focal point for community groups interested in salmonid enhancement in this area.

Information about timing and contribution of Bulkley River coho and chinook stocks to commercial, sport and native fisheries is scarce at best. Coded-wire tagged releases from Toboggan Creek will no doubt expand the information available concerning these stocks. This should lead to better management of the existing wild coho and chinook stocks in the Bulkley system and also provide useful information about hatchery strategies for these two species in the upper Skeena drainage.

This facility was built during the fall and winter 1984. The site will be landscaped and the rearing channel upgraded in 1985. Pilot production goals for 1985 are; 75,000 Morice River chinook, 50,000 Toboggan Creek coho and 50,000 Bulkley River steelhead eggs.

Contact: Mike Whately, Head,
Fisheries, Fish and Wildlife
Branch, Smithers; Matthew
Foy, Biologist, Small
Projects Unit.

Kincolith Band Project

The Kincolith hatchery is located on the Kincolith River near the mouth of the Nass River. The project provides full-time employment, incubating and rearing coho and chinook fry, for two Band members and part-time employment for up to eight more.

In 1984, 100,000 coho fry were released in the Kincolith River and an additional 7,000 were released into a semi-natural rearing pond for overwintering. The pond was excavated this year to allow for production of coho smolts instead of fed fry. Pending the evaluation of this year's results, this pond will be used for the majority of this facility's coho production. The 15,000 chinook fry produced this year were released on July 29.

The egg-takes for the 1984 brood year were 60,000 for chinook and 130,000 for coho.

Other activities undertaken during the year included a downstream trapping program to determine the timing of migration of chinook and coho smolts, construction of a building to house the Capilano troughs, excavation of a second pond for brood stock holding, and construction of a bridge to improve access to the hatchery during high tides. Again, job creation programs were important in enabling these projects to be undertaken.

Contact: Bruce Wright, Project
Coordinator, Special Projects
Division.

Kitsumkalum Reconnaissance/ Feasibility

In 1984, consultants were preparing two reports on Kitsumkalum. EVS Consultants Ltd. was compiling the adult and juvenile biobaseline data collected between 1975 and 1980; Aquatic Resources Ltd. was summarizing the results of the Dry Creek pilot hatchery's 1980-83 operations. Both of these reports should be available in 1985.

Contact: Gordon Bérézay, Operations
Support Biologist; Don
McKinlay, Design Biologist,
Enhancement Operations.

North Coast Reconnaissance

Bioengineering reconnaissance surveys were conducted by helicopter in Statistical Areas 3-6 during 1984. These surveys were undertaken to obtain missing information on potential opportunities for salmonid enhancement projects, as identified in the 1983 preliminary report by the Enhancement Opportunities subcommittee.

The following systems were examined in September, 1984: the Shawatlar and Ecstall systems in Area 4; Porcher Inlet streams, Wilson Inlet Creek, Curtis Creek, Moore Cove Creek, Kumeleon Creek, and Lowe Inlet in Area 5; Butedale, Surf Inlet and Swanson Bay in Area 6. The amount of physical potential for enhancement projects in Area 6 is outstanding. There are a number of large 'hanging lakes' located at tidewater, offering large amounts of gravity-feed lake water for power and fish culture; most of the systems already have been developed to some degree for other purposes such as logging or fish processing, and these existing structures possibly could be double-used for enhancement facilities.

In November, 1984, systems examined included the Nass watershed upstream of Greenville, Alice and Hastings Arms and the Bear River watershed.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielson, Senior Project Engineer, Engineering.

Bear/Sustut Reconnaissance

The Bear and Sustut Rivers are major headwater tributaries of the upper Skeena watershed. The chinook stocks of both these rivers have been proposed for enhancement via satelliting to a central hatchery located at the Fulton river spawning channel. Adult surveys of the Bear and Sustut Rivers were undertaken in the 1970s, but juveniles had never been studied. Therefore, Envirocon Ltd. undertook juvenile migration and biophysical rearing surveys in 1984, with a view to establishing outplanting potential for these systems. The contractor's report will be available in 1985.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Whitehorse Rapids Mitigation Facility

This facility was built by the Northern Canada Power Commission (NCPC), with advice from the SEP Enhancement Operations group. SEP undertook cold-weather testing of this facility early in 1984. Results indicated that the facility could be operated successfully during the winter. This facility began operation October 4 with 160,000 chinook eggs taken from adults captured at the Whitehorse Rapids fishway. Funding of the operation remains uncertain, and continues to be discussed at the DFO and DINA ministerial level in Ottawa.

Contact: Gordon Bérézay, Operations Support Biologist; Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Provincial Status Report

Sustut River Reconnaissance

The Sustut River is located about 160 km north of Smithers and is a major tributary of the Skeena River. Tributaries of the Sustut include the Bear River, Asitka River and Johanson Creek.

The Sustut has long been known for its run of large steelhead trout. Angling pressure has been relatively light due to the remoteness of the system, although in the 1970s, construction of the British Columbia Railway (BCR) and the associated airstrips created new access and hence increased angling pressure. Because of the new access, regulations banning angling in waters above the Bear-Sustut confluence were instituted to protect this vulnerable stock.

There has been one angling guide operating on the river for 17 years; two others started operations in 1984.

Due to recent management and enforcement concerns, a reconnaissance survey was started in 1983 to gather biological data for Sustut steelhead as well as create a higher enforcement profile in the area. This program was expanded and continued into 1984 to refine information gathered in 1983.

Fisheries Branch personnel made six trips to the Sustut during the peak of the steelhead fishery in September and October 1984. Sample sites were established throughout the drainage to obtain data on growth and densities. Scale samples were obtained form 65 adult steelhead which were also tagged before their release.

The Fisheries Branch maintained a high profile through the presence of Branch personnel and through angler checks.

Seventy-four steelhead were spaghetti tagged to aid in identification of run timing in the commercial fishery at the mouth of the Skeena. The predominant age groups were 4.2^{+} (55 percent) and 4.1^{+} (17 percent). In 19-

85, the study will be continued in order to derive a population estimate for the Sustut.

Skeena Fry Stocking and Assessment

Most work is focused on tributaries of the Skeena that are major producers of summer-run steelhead. To date, systems that have been examined include the Bulkley River and its tributaries, and the Kispiox, Kitsumkalum, Morice, Suskwa, Sustut and Zymoetz (Copper) Rivers.

The primary focus of the provincial Salmonid Enhancement Program in the Skeena region has been Skeena River summer steelhead. Production of more steelhead in the Skeena River is presently based almost solely upon fry stocking above barriers or in underutilized habitat.

In conjunction with the Fisheries Branch habitat improvement section, Skeena tributaries have been surveyed to determine baseline biological data on juvenile steelhead densities and survival rates. Barren habitat has been located in Harold Price Creek and in the Morice and Zymoetz Rivers which are presently stocked annually or biannually with summer steelhead fry.

An integral part of the fry stocking project is the annual assessment of stocked systems to determine the survival of fry and parr. This assessment procedure determines the success of the fry plants and refines the target for fry stocking in following years.

The juvenile assessment phase of the 1984 program was divided into two parts, the first of which was the annual monitoring of index sites throughout the Skeena drainage. These sites are sampled every year during specified times so that annual comparisons of juvenile densities and survivals can be made. The second part of the juvenile assessment was the sampling of previously unsampled systems in the Skeena to investigate feasibility of fry stocking in the future.

Based on data of similar work in previous years, the Morice River and Harold Price Creek were stocked with steelhead fry. All planted fry were progeny of wild brood stock from the stocked systems.

The stocking of the Morice River system began in 1983 with 70,000 summer steelhead fry stocked above barriers and in underutilized areas. In 1984, this was continued with an additional 62,000 fry. Post-stocking assessment indicated that the stocked juveniles are doing well.

The Suskwa River project consists mainly of stocking above the falls on Harold Price Creek. This stocking began with a pilot project in 1979, with subsequent stockings in 1980 and 1982. Encouraging returns have already been seen from fry stocked during the small pilot project in 1979. In 1984, only 50,000 fry were stocked in the system because of the limitations in holding large numbers of brood stock. The target for Suskwa in 1985 is 180,000 fry which should produce about 900 returning adult steelhead.

Kispiox River Steelhead

The Kispiox River system, a major tributary to the Skeena River, is renowned for its trophy-size steelhead. Although population estimates have been attempted in the past, there is a lack of recent information about the size of the population. A recently-developed computer model calculates the population size on an annual basis but this must be checked and verified occasionally before it is used on a management basis. The first year of a two-year population estimate began in 1983.

As in 1983, the 1984 population estimate used a mark and recapture method to tag steelhead and then estimate the total population from the fish that are recaptured.

Three hundred and ninety-eight steelhead were captured and tagged. From a recapture of 28 fish, it was determined that the Kispiox steelhead population in 1984-85 was 2,400. This is somewhat higher than the 1983 population of 1,300 steelhead, but in both cases the estimates agree with the predicted data from the computer model. It is anticipated that the status of adult steelhead will be monitored regularly as part of an ongoing stock assessment program.

Contact: Mike Lough, Fisheries
Biologist, Fisheries Branch,
Smithers.

Job Creation Projects

Habitat Inventory and Hatchery Support

Habitat inventories were conducted on nine streams: Thornhill, Clearwater, North Hatchery, Andalas, Schulbuckhand, Alwyn, Deep, Sockeye and Mink Creeks.

On Thornhill Creek, a counting fence was built to determine the escapement and timing of coho and pink salmon. The pink run was estimated at 50 pairs of spawners. Ten pairs of coho spawners were transported above the falls. The run was estimated at 107 coho.

One member of the job creation crew acted as a tour guide at Kitimat hatchery. About 1,300 people visited the facility.

The crew also helped local volunteer projects:

- Williams Creek: assisted in collection of sockeye brood stock and helped with egg-take and planting
- Diana Creek: assisted in coho brood stock capture and egg-take
- Eby Street hatchery: cleaned and prepared rearing ponds and incubation trays; constructed a counting fence on Clearwater Creek and collected coho brood stock.

General stream reconnaissance was also conducted on Schulbuckhand Creek, Lakelse River and Kofeod Brook.

Kispiox Hatchery

This job creation crew rebuilt the hatchery's aeration tower, constructed rearing raceways for overwintering chinook and built a plywood tank for coho and chinook fry outplants. In addition, crew members also helped with the general operation of the hatchery, including cleaning rearing troughs, feeding fry, collecting brood stock and releasing fry.

Kloiya River System

A creel survey of Kloiya Bay fishermen was conducted to determine the impact of the sport fishery on chinook escapement to Kloiya River and to provide specific biological data on the chinook stock.

A second creel survey on Prudhomme and Taylor Lakes was carried out to document the coho fishery and its impact on escapements to Prudhomme and Diana Creeks and to provide specific biological data on the system's salmon stocks.

In addition, the crew helped to design, build and install an adult fish trap in the Kloiya dam fishway. This will allow the escapement above the dam to be monitored.

The juvenile salmon habitat use under the influence of different dam discharges was also studied.

Kincolith Hatchery

The job creation crew built a bridge for better access across the river to the hatchery during periods of high water.

The crew also helped with the chinook egg-take (approximately 10,000 eggs were taken); helped to transfer 75,000 fry from the holding tanks to the rearing ponds and helped with finclipping.

Toboggan Creek

A job creation crew built a hatchery on Toboggan Creek, a tributary of the Bulkley River. This project was a joint project of the Small Projects Unit of SEP and the provincial Fisheries Branch. Workers participated in all aspects of the construction, including installation of pipelines and intakes, erection of an aeration tower, and completion of the hatchery building. Twelve hundred coho eggs were taken for incubation.

Kitsumkalum River

The Kitsumkalum Band sponsored this project to conduct biophysical reconnaissance on groundwater sites for the Band's pilot hatchery. The crew also identified coho fry salvage opportunities in Kitsumkalum tributaries and constructed a wooden intake box and installed pipelines for the hatchery. They captured 25 coho brood stock and planted 19,400 eggs in the hatchery's incubation boxes.

Deep Creek Hatchery Assistance

Deep Creek hatchery is operated by the Terrace Kitsumkalum Salmonid Enhancement Society. Job creation workers helped hatchery staff in:

- chinook fry maintenance and ponding, including transferring alevins from Heath trays to Capilano troughs, feeding fry, taking growth measurements, treating for disease
- feeding, on a weekly basis, 10,500 penned supersmolts on a Copper River side channel
- digging a large trench for an alternate water source for the Deep Creek rearing ponds
- building footbridges over Deep Creek.

Contact: Chris deHrussoczy-Wirth,
Head, Employment Development,
Special Projects Division.

Table 36

Public Participation Projects

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Kloiya Creek	Northern Trollers Assn.	6	6	incubation	chinook	29,000	84	870
Diana Creek	Northern Trollers Assn.	3	6	incubation	coho	18,000	90	216
Lakelse River	Uplands Elementary School	26	3	incubation in school	coho	500	63	8
Lakelse River/ Thornhill Creek	Thornhill Elementary School	30	3	incubation in school	coho	540	90	8
Lakelse River/ Thornhill Creek	Caledonia Secondary School	25	4	incubation in school	coho	Eggs were eaten by coho yearlings left in the aquarium.		

NORTH COAST PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1984	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1984 Releases
Lakelse River	Copper Mountain Elementary School	32	3	incubation in school	coho	240	60	4
Lakelse River	Clarence Michiel School	130	5	incubation in school	coho	350	78	5
Thornhill Creek	Skeena Junior Secondary School	10	3	incubation in school	coho	90	23	1
Hirsch Creek	Alexander Elementary School	40	1	incubation in school	coho	220	73	3
Toboggan Creek	Chandler Park School	60	1	incubation in school	coho	500	63	8
Lakelse River	Eby St. Hatchery	4	1	incubation	coho	329,000	95	4,935
Kispiox River	Kispiox School	30	1	incubation in school	coho	250	63	4
Kitimat River	Kitimaat School	40	1	incubation in school	coho	200	67	3
Kispiox River	Kitwanga School	27	1	incubation in school	coho	Eggs killed from unknown cause.		
Kincolith River	Nathan Barton School	15	1	incubation in school	pink	190	95	5
Kitimat River	Nechako Elementary School	26	1	incubation in school	coho	100	33	2
Kathlyn Creek	Smithers and Bulkley Valley Christian Schools	40	1	incubation in school	coho	200	25	3
Toboggan Creek	Smithers Secondary School	24	1	incubation in school	chinook	340	97	2
Sockeye Creek	Ron Dena	4	1	incubation	coho	106,000	95	1,440
Bulkley River	Emerson Creek Hatchery	3	4	incubation	chinook	144,000	93	691
Tseax River	Nishga Elementary School	11	6	incubation	coho	30,000	75	360

Rainy Creek	Stewart Secondary School	18	3	incubation in school	coho	350	35	5
						High mortality due to infertile eggs.		
Rainy Creek	Stewart Elementary School	30	1	incubation in school	coho	400	50	6

Contact: Barry Peters, SEP Community Advisor.

Table 37

North Coast SEP Facilities*: Juvenile Releases 1984

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size (g)
Terrace Kitsumkalum Salmonid Enhancement Society						
Not available at time of printing.						
Kispiox Band Project						
Not available at time of printing.						
Babine Facilities						
Sockeye	1984	Fulton	58,500,000	10	13	N/A
Sockeye	1984	Pinkut	57,500,000	0	47	N/A
Fort Babine Community Development Project						
No releases in 1984; rearing coho for release in 1985.						
Kincolith Band Project						
Not available at time of printing.						

* Includes facilities constructed prior to SEP.
N/A means "not available."

Table 38

North Coast SEP Facilities*: Status at December 1984

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Kitsumkalum Community Development Project							
Chinook	Kitsumkalum	84	alevin	23,270	May 1985	22,500	Kitsumkalum
Coho	Kitsumkalum	84	egg	18,496	July 1985	18,000	Kitsumkalum
Terrace Kitsumkalum Salmonid Enhancement Society							
Chinook	Kitsumkalum	84	alevin	207,000	May 1985	200,000	Kitsumkalum
Chinook	Copper R.	84	fry	31,000	Nov. 1985	30,000	Copper R. side channel
Chinook	Cedar R.	84	fry	33,000	May 1985	32,000	Cedar River
Kispiox Band Project							
Chinook	Kispiox	83	fry	3,848	May 1985	3,848	Kispiox
Chinook	Kispiox	84	fry	197,000	May 1985	15,000	Kispiox
					Nov. 1985	45,000	Kispiox
Coho	Kispiox	84	egg	108,000	Oct. 1985	68,000	Kispiox
					May 1985	15,000	Kispiox
Babine Facilities							
Sockeye (Fulton)	Channel #1	84	egg	23,700,000	May 1985	9,500,000	Fulton
	Channel #2	84	egg	162,900,000	May 1985	57,000,000	Fulton
	River	84	egg	269,700,000	May 1985	53,900,000	Fulton
Sockeye (Pinkut)	Channel	84	egg	73,200,000	May 1985	36,600,000	Pinkut Cr.
	River	84	egg	118,000,000	May 1985	12,900,000	Pinkut Cr.
Fort Babine Community Development Project							
Chinook	Babine R.	84	egg	58,000	Oct. 1985	25,000	Babine R.
					May 1986	25,000	Babine R.
Coho	Babine R.	84	egg	63,400	Oct. 1985	60,000	Babine R.
Kincolith Band Project							
Coho	Kincolith	84	eggs	130,000	Oct. 1985	120,000	Kincolith
Chinook	Kincolith	84	alevin	60,000	June 1985	55,000	Kincolith
Coho	Kincolith	83	fry	7,000	Apr. 1985	7,000	Kincolith
Whitehorse Rapids Mitigation Facility							
Chinook	Yukon River	84	fry	121,000	May 1985	115,000	Mitchie Cr.

* Includes facilities constructed prior to SEP.

Table 39

North Coast SEP Facilities*: Escapement to Facility 1984

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked (male and female)
		male	female	
Babine Facilities				
Sockeye (Pinkut)	147,000	natural spawning		--
Sockeye (Fulton)	367,000	natural spawning		--

* Includes facilities constructed prior to SEP.

Table 40

North Coast SEP Facilities*: Adult Production

	Expected Production from 1984 Releases			At Full Production		
Species	Total Adult Production	Years of Return	Contribution to Fisheries (pieces)	Total Adult (pieces)	Contribution to Fisheries (pieces)	Contribution to Fisheries (lbs)
Kitsumkalum Community Development Project						
Not available at time of printing.						
Terrace Kitsumkalum Salmonid Enhancement Society						
Not available at time of printing.						
Kispiox Band Project						
Not available at time of printing.						
Babine Facilities						
Sockeye (Fulton)	579,150	1985-88	242,106	1,026,000	428,868	2,657,402
Sockeye (Pinkut)	569,250	1985-88	237,967	432,000	180,576	1,118,906
Fort Babine Community Development Project						
Not available at time of printing.						
Kincolith Band Project						
Not available at time of printing.						
Whitehorse Rapids Mitigation Facility						
Not available at time of printing.						

* Includes facilities constructed prior to SEP.

1. Lake fertilization continued at Vancouver Island locations; here fertilizer is dropped into Sproat Lake.
2. Extensive testing to assess fertilization potential of Interior lakes began in 1984. Here the crew takes water samples on Chilko Lake.

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Federal Research

Juvenile Production Strategies

Size and Time at Release

The purpose of these studies is to determine the optimum size and time for release of juvenile salmonids in order to obtain maximum adult returns. Studies are either underway or have been completed on coho and chinook and have just begun on chum salmon. The coho studies have been conducted at two hatcheries to examine for site-specific differences and all releases of coho and chinook have been repeated for at least two years to examine for annual variability.

a) Coho studies

Studies have been conducted at Quinsam and Capilano hatcheries. At each location, three sizes of nose-tagged juveniles were released on each of four dates within the period mid-April to early July. Releases were made in 1980 and 1981 from Quinsam and 1981 and 1982 from Capilano. A third release was made from Quinsam in 1983. This consisted of three sizes of juveniles released on May 30. The purpose of this release was to provide further information on the effects of size at or near the optimum release date. Recoveries are now complete at both locations. Final analysis and reporting of most studies is dependent on receipt of final U.S. fishery data. A technical report on the 1980 Quinsam releases was published in 1984. For Quinsam (a warm-water hatchery), the 1980 study indicated maximum adult returns (catch plus escapement) of 11.2 percent could be expected from release of juveniles of about 15.7 g on June 4. Since this weight was below the tested weight range for this date, a release weight of 20 g (with 10.2 percent returns) was recommended until the lower weight could be tested. Preliminary results for the 1981 Quinsam releases agree closely with both a 20 g optimum release weight and the optimum release date of June 4. Preliminary results from the single release in 1983 (adults recovered in 1984) support the results of the two earlier releases, all three studies indicating higher adult returns from smaller smolts for May 30 releases.

For Capilano hatchery (a cold-water hatchery), analysis of available data from the first year's releases predicts maximum adult returns of 14.1 percent from release of 19 g juveniles on June 1. Time of release was less critical at Capilano than at Quinsam.

In summary, results so far indicate little difference in optimum size and time for release of juveniles between Quinsam and Capilano hatcheries and annual variability (at least for Quinsam) is low. It should be noted, however, that the possibility of site-specific differences should not be ruled out, since a study previous to these at Rosewall Creek showed maximum adult returns of 43.5 percent from release of juveniles on June 22. The results also indicate it is possible to approximately double coho production at Quinsam by altering the release strategy used up to the time of these studies. Only minor gains might be expected at Capilano since the time and size for release now being used are very close to those indicated as optimal by these studies.

b) Chinook studies

Tagged juveniles of three sizes were released from Quinsam hatchery on May 5, May 26, June 16, and July 7, in both 1982 and 1983. A data report describing the 1983 releases was published in 1984. Small numbers of jacks from the 1982 releases were recovered in the 1983 escapement. In 1984, recoveries of jacks (from 1983 releases) were also low; however, substantial numbers of three-year-olds from the first year's releases were recovered. These indicate generally higher returns from larger juveniles, with May 26 as the best release date. Predominant ages at Quinsam are four and five-year-olds and higher returns are therefore expected in 1985, with recoveries continuing until 1988.

c) Chum studies

A study was begun at Conuma hatchery with the collection of 650,000 eggs in October 1984. These are being incubated under three temperature regimes to produce small, medium, and large fry. Releases of the three size categories are planned for March 25, April 15, May 6, and May 27, 1985. This will require the nose-tagging and release of 540,000 fry. Adult recoveries will be required in 1987 and 1988.

Steelhead Size and Time and Parental Age Studies (Rosewall Cr.)

The purpose of these studies is to examine the influence of environmental factors and age of parent on the growth, survival, and age at maturity of progeny. Such information could be valuable to fish culturists in maximizing returns and in achieving specific objectives, such as production of fish with a longer ocean residency, which would be larger upon return and therefore more desirable to anglers.

Releases were made in 1979, 1980 and 1981. Adult recoveries from 1981 through 1984 have shown the optimum date for release is late April and that returns increase significantly with increasing size of juvenile. Zero returns are indicated for juveniles released at 23 g or less. No significant effect of parental age on the age at maturity of progeny has been detected; however, it does appear possible to alter the age composition of returns indirectly through controlling the size of juveniles at release. This is due to the fact that the increased returns observed for larger juveniles are largely 2-ocean fish, while returns of 3-ocean fish do not appear related to size of juvenile. Release of larger juveniles would therefore result in increased returns with a higher proportion of 2-ocean fish.

In 1982, thirty-two tagged groups of smolts were released. These resulted from more detailed studies on the effects of parental age and involved replicated 2 x 2, 2 x 3, 3 x 2, and 3 x 3 parental ocean-age crosses using four sets of parents. Growth until release was monitored closely. This study was repeated (with slightly modified design) and the resulting 33 groups of tagged smolts released in 1983. First recoveries from these crosses were in spring 1984. Returns were very low, probably due mainly to the late date of release (May 27), the optimum time not being known when the release was made. Although the returns were too low to draw any conclusions on the effects of parental age, there are indications of the possibility of such effects. Higher returns are expected from the 1983 release when the release date was near optimal (May 2) and juveniles were larger. First returns from this release will be in 1985. Final returns for these studies will be in 1986.

Contact: Bruce Morley, Tom Bilton, and
Doug Brouwer, Fisheries
Research Branch, Pacific
Biological Station, Nanaimo.

Lake Enrichment Program

Limnology

The purpose of this program is to increase sockeye salmon production in selected British Columbia lakes through the controlled addition of nitrogen and phosphorus fertilizers. Specific activities of various components of the program include:

- controlling fertilizer applications to the lakes
- conducting limnological investigations of untreated sockeye nursery lakes to determine their suitability as candidates for fertilization
- conducting investigations of fertilized lakes to assess the effects of

various fertilizer application strategies

- conducting field and laboratory experiments to determine fertilizer application strategies which stimulate growth of preferred phytoplankton and zooplankton species.

a) Fertilizer applications

In 1984, twelve lakes were treated with nitrogen and phosphorus fertilizers. Three lakes on the Queen Charlotte Islands (Awun, Eden, Yakoun), three lakes on the north coast (Bonilla, Curtis, Devon), one lake on the central coast (Long), and four lakes on Vancouver Island (Great Central, Henderson, Kennedy, Nimpkish) were fertilized once or twice weekly with aqueous solutions of ammonium phosphate and ammonium nitrate. Fertilizer composition and loading rates were modified to fit the specific requirements of each lake and all applications to these lakes were done by a DC-6B water bomber.

In addition, a feasibility study of an alternative method of fertilizer application was carried out on Muriel Lake, which is located near Kennedy Lake. Rafts containing slow-release fertilizer pellets (pellets consisted of calcium phosphate and urea encapsulated in a resin) were deployed for five months around the lake. Post-fertilization studies will be carried out in 1985 and the effect of this form of fertilization and its cost relative to aerial fertilization determined.

b) Prefertilization studies

Intensive investigations were carried out on Chilko and Sproat Lakes to determine their suitability for fertilization and to determine appropriate fertilizer composition and loading rates. Prefertilization studies on Sproat Lake are complete and fertilization of Taylor Arm of Sproat Lake will commence in May 1985, and intensive sampling to monitor fertilizer effects will be carried out. The Sproat Lake studies have found that, unlike most lakes, substantial production there occurs during late winter (February-March), and further research may indicate that fertilizer applications to this lake should be modified accordingly.

Chilko Lake studies were carried out from July-October, 1984. The lake is oligotrophic, with very low levels of inorganic nutrients (nitrate and phosphate). Because of its large size and subalpine location and because of the windy conditions which prevail much of the time, the lake is physically far more complex than any lake thus far investigated or treated. This physical complexity results in considerable instability in lake thermal structure (upwelling), and in considerable patchiness in plankton production and biomass distribution. For example, an area of the lake which has stable stratification (and is suitable for fertilizer application) may, as a result of heavy winds, become isothermal and remain so for several days until a period of calm weather permits stratification to redevelop. Fertilizer applied during times and to areas of the lake which were undergoing this rapid vertical mixing could potentially have no beneficial results. In 1985, regions of the lakes which are most subject to this instability will be documented in order to better understand how this pattern affects plankton production.

c) Fertilized lake investigations

All fertilized lakes were sampled in accordance with provincial Waste Management Branch regulations. Great Central, Henderson, Kennedy, and Nimpkish Lakes were studied more intensively to determine effects of specific fertilizer application strategies. All lakes responded positively to fertilizer applications, and a highlight of the year's work was the virtual elimination of an undesirable (i.e. not utilizable by zooplankton) large phytoplankton species from Nimpkish Lake by modifying the fertilizer composition. In addition, phytoplankton species which are satisfactory food sources for zooplankton were present in greater numbers in Nimpkish Lake in 1984.

d) Food-web research

Process-oriented studies were initiated in 1984 to refine our understanding of the food webs supporting juvenile sockeye in coastal B.C. lakes. Initial work was directed towards defining the pathways of energy transfer between the phytoplankton and zooplankton communities. Phytoplankton species representative of the dominant taxa and size categories in the study lakes were isolated and cultured in oligotrophic growth media. Radiolabelled phytoplankton were used in field experiments to define their utilization or nonutilization as food resources within the zooplankton community. Results from these continuing studies will identify phytoplankton species and size categories that are not effectively utilized by the zooplankton, and determine responses of lake phytoplankton communities to nutrient fertilization that ensures an efficient energy transfer to the zooplankton community. These experiments will determine if there is an algal food quality problem in fertilized coastal lakes that reduces the efficiency of nutrient fertilization to increase the zooplankton food resources of juvenile sockeye. Resolution of this question will provide the rationale for controlled experiments to fine tune the fertilizer composition and application strategies of whole-lake fertilization.

Contact: Dr. John Stockner, Section Head, Enrichment Research;
Ken Shortreed, Biologist,
Erland MacIsaac, Biologist;
West Vancouver Laboratory;
Ken Stephens, Technician,
Pacific Biological Station,
Nanaimo.

Fish Ecology Unit Studies

There are three key questions which ultimately must be answered as a prerequisite to future analysis of the benefit-cost effectiveness of lake treatment as a tool for enhancing the production of sockeye salmon stocks. These are:

1. Does lake fertilization generally influence the size attained by juvenile sockeye so that smolts routinely leave at a larger size from treated as opposed to untreated coastal lakes?

2. Will larger sockeye smolts experience higher survivals or exhibit changes in age-at-return such that the harvestable biomass of adult sockeye available to the fishery is increased enough to more than compensate for the costs associated with this form of enhancement?

3. Does lake fertilization influence the within-lake survival of juvenile sockeye so that more smolts are produced per spawner in treated years as opposed to untreated years?

Reports by Hyatt and Stockner (due in 1985) and Stockner and Hyatt (1984) have summarized recent findings. First, a strong case can be made that, on average, fertilization of outer coast sockeye nursery lakes is promoting the production of smolts that are larger relative to their untreated counterparts. Since ample evidence exists in fisheries literature specifically (see reference in Hyatt and Stockner, 1985) and ecological literature generally that larger-sized juvenile fish will experience higher survival to adults, these authors support predictions of significant gains in sockeye stock returns due to lake fertilization. Expectations of long-term stock productivity increases of two-fold or greater are not unrealistic given the observed smolt size increases and data published elsewhere on effects of increased size on marine survival (Ricker 1963).

Uncertainties that remain as targets for ongoing assessments are related to whether:

- lake treatment is effective in producing tangible growth, size and survival benefits in situations where sockeye fry abundance is very low
- the size and marine survival relationship established by Ricker (1962) for smolts between 5-30 g will prove to be directly applicable to the 1-6 g sockeye smolts typically migrat-

ing from treated and untreated outer coast lakes.

Approximately two more years of assessments of a wide range of treated and untreated coastal lakes will be required to clarify the first uncertainty, while considerably longer assessment (10-15 years) are underway on a limited number of study stocks (approximately 6) to generate the necessary observations to test the applicability of the Ricker marine survival relationship for outer coast sockeye stocks currently under treatment.

The third question posed regarding whether lake treatment increases in-lake survival of juvenile sockeye has been the most intractable to date due to the logistics difficulties such assessments face when focused on large, commercially important stocks of sockeye. However, some encouraging results are available from research currently being conducted by the Lake Enrichment Program (LEP) Fish Ecology Unit.

The LEP Fish Ecology Unit has completed a within-lake survival assessment at Hobiton Lake under treated conditions and has recently obtained the first within-lake survival estimate from Hobiton under untreated conditions. The comparison to date indicates an average within-lake survival (from potential eggs to presmolts) of 4.7 percent under treated conditions (range 4.25-5.58, N=3) while the single observation completed in October 1984, under untreated conditions is of a 1.02 percent survival. If borne out in subsequent assessment years, this result suggests lake treatment may permit the production not only of larger smolts but also of more smolts from a given egg set. The latter result is consistent with evidence presented by LeBrasseur et al. (1978) for an in-lake survival of lake treatment at Great Central Lake.

A minimum of two to three more years of within-lake survival assessment for Hobiton Lake sockeye under untreated conditions will be required to complete replicate observations for this untreated to treated survival study. A second comparison of within-lake survival of juvenile sockeye under treated and untreated conditions may be completed by the fall of 1988 if Sproat Lake treatment is initiated in the upcoming year (1985). These assessments are critical to future benefit/cost appraisals of lake enrichment performance since forecasts of increases in adult sockeye returns attributable to lake treatment are extremely sensitive to assumptions about the magnitudes of both sockeye fry and smolt survival changes induced by lake treatment.

In addition to ongoing field assessments, emphasis over the next year will continue to be on analysis and reporting of the last few years of assessment results. In this regard, a number of reports which are now in press will soon be available to indicate the general responses that have been observed by sockeye stocks under treatment along the coast. The evidence to date supports the view that lake enrichment program activities may account for 50 percent or more of the yield produced in recent years by coastal stocks of sockeye that have been under treatment. Further, one report (Stockner and Hyatt, 1984) emphasizes that a generally unrecognized benefit of the lake enrichment program's activities in increasing sockeye production is providing information on the productive capacity of particular sockeye stocks in lakes. Both lake treatment effects and improved advice to managers on how to manipulate the stocks to maximize productivity of treated (Henderson, Great Central and Hobiton) and untreated (Sproat) stocks have played a role in generating substantial increases in the number of adult sockeye available for harvest. Clearly the landed value of fish from these four stocks alone exceeds the annual cost of the lake enrichment program by a factor of 2-3.

Contact: Dr. Kim Hyatt, Head, Fish
Ecology Unit, Lake Enrichment
Program, Pacific Biological
Station, Nanaimo.

Disease Control

Bacterial kidney disease (BKD) is an important, widespread, and chronic disease of salmonids, and evidence suggests that the disease causes its greatest losses in hatchery-reared Pacific salmon after the fish have left their hatcheries and gone to sea. In addition, the disease promises to be a major problem in Pacific salmon, pen-reared in seawater, particularly in fish that are to be held for brood stock purposes or that are to be reared to large size for marketing.

The feeding of antibiotics to control BKD has not resulted in satisfactory control, and vaccination has proved ineffective in preventing the disease in Pacific salmon. These facts have focused attention on other approaches for controlling BKD.

Data obtained in the laboratory have proved that the kidney disease bacterium (Renibacterium salmoninarum) can be transmitted from parent to progeny within the salmonid egg. This is likely an important means by which the pathogen maintains itself in salmonid populations in nature. Control of BKD might therefore be possible by breaking the infection cycle at the egg stage. The eggs acquire their infections (via the micropyle) from the heavily infected coelomic fluid that surrounds them in certain "culprit" fish. Males apparently contribute little to this process because fertilization of eggs through heavily infected coelomic fluid (a process analogous to fertilizing the eggs with heavily infected milt) appears to result in no increases in the egg infection rate.

The risk of obtaining infected eggs can be greatly reduced if the eggs are taken from fish with clear, rather than cloudy, coelomic fluid. Cloudiness in coelomic fluid has invariably been indicative of large numbers of R. salmoninarum cells in the fluid, and eggs from fish with cloudy fluid have always been found to be infected internally (5-15 percent of the eggs). Further, neither "tamed" iodine nor the antibiotic, erythromycin, when applied to eggs at high levels for extended periods during or following water hardening, proved capable of eliminating the internal egg infections. Reasons for the lack of efficacy of these antimicrobial agents is now clear: the agents accumulate only in the perivitelline space in the egg and are rapidly leached from the eggs once the eggs are incubated in running water. To be effective, the antimicrobial compounds must be retained in the eggs for perhaps two to three weeks, and they must also accumulate in the yolk where the pathogen also occurs.

Work is progressing on egg disinfection techniques that promise to overcome the foregoing problems. However, until these procedures are perfected, the best approach to avoiding egg-mediated BKD problems is to obtain eggs from stocks known to be free of R. salmoninarum. In the absence of such stocks, the risk of infection posed by eggs can be minimized by injecting brood fish with erythromycin (20 mg/kg fish into the dorsal sinus) prior to spawning. If only one injection is to be given, it should be administered no earlier than two months, and preferably at one month, before spawning. This procedure decreases the likelihood of egg infections by reducing the number of R. salmoninarum cells present in the coelomic fluid. It also arms the eggs with therapeutic levels of erythromycin that persist at least to the egg-hatching stage (long enough, it is thought, to eliminate any intraovum infections that may have occurred). The injection procedure, taken together with a monitoring of milt and of coelomic fluid from the females (to serve as an index of the pathogen's absence in the reproductive products), provides the most practical available method for breaking the egg-mediated BKD infection cycle. For BKD control to be completely effective, however, appropriate precautions must be taken to avoid infections with the waterborne pathogen.

Contact: Dr. Trevor Evelyn, Research Scientist, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Diagnostic Service

The Diagnostic Service, centered at the Pacific Biological Station, Nanaimo, is a clinical fish health laboratory. A staff of two biologists and three technicians provides assistance to SEP by diagnosing the cause of fish health problems and advising fish culturists on appropriate corrective measures.

The control and prevention of fish diseases are essential to the successful operation of SEP facilities. To achieve these goals many of the principles of disease management used in rearing domestic animals are applied. These include quarantine measures, sanitation and disinfection procedures, immunization, stress avoidance, and chemotherapy.

By applying the above principles and constantly improving hatchery management techniques and disease detection methods, many of the infectious diseases can be successfully controlled or prevented. For instance, although bacterial kidney disease remains a common, often serious, problem in privately-operated aquaculture facilities, it now causes only minor losses in SEP hatcheries. Much of this success can be attributed to improved rearing procedures, increased disease awareness by hatchery staff, and control programs carried out by the Diagnostic Service.

Other diseases, such as furunculosis, a general bacterial septicemia of salmonids, still occur frequently in SEP facilities. However, early detection, improved rearing techniques and more effective treatment methods have prevented serious losses. Recent field tests by the Diagnostic Service have demonstrated that outbreaks can be effectively controlled by the oral administration of oxolinic acid, especially if administered before losses have started to increase sharply.

The second most frequently encountered fish health problem in 1984 was bacterial gill disease. This malady is most common in alevins and fry debilitated by environmental conditions. Generally, the disease occurs in small facilities where less control can be exercised over environmental conditions or new facilities where site-specific problems must be understood and resolved before the disease can be fully controlled. Chloramine T, a readily available disinfectant used in the dairy industry, has recently proven effective against this disease.

The viral disease infectious hematopoietic necrosis (IHN) has been identified as an important cause of losses among sockeye alevins and fry at the Fulton River facility. No treatment methods have been developed to combat this disease. The fish culturist must rely solely on stock management procedures and manipulation of rearing conditions to minimize losses.

A pilot project was undertaken to determine the feasibility of screening chinook adults for infectious agents following collection of eggs and milt. By using eggs and milt from disease-free parent stock, the possibility of disease transmission via the fertilized egg should be substantially reduced or eliminated. The results indicated that the procedure has practical application, particularly in the private sector where smaller numbers of eggs are required.

Proliferative kidney disease (PKD), a protozoan disease of salmonids, was diagnosed for the first time in Canada at the Puntledge River hatchery in 1983. Since then, the disease has also been encountered at the Robertson Creek and Chehalis River hatcheries. PKD has not been newly introduced, but rather, improved diagnostic procedures have allowed its detection. No effective chemotherapeutic measures are known; however, mortalities do not begin until the water temperature exceeds 15°C. At Robertson Creek, it was possible to control losses by using cool water below the thermocline of Great Central Lake.

Table 41

Infectious Diseases and Disease Agents, 1984

Bacterial	**Number of occurrences**
Furunculosis	44
Myxobacterial gill disease	24
Bacterial kidney disease	19
Vibriosis	19
Myxobacteriosis	18
Other bacterial gill diseases	15
Coldwater disease	10
Enteric redmouth disease	6
Columnaris disease	3
Viral	
Infectious hematopoietic necrosis	3
Parasites	
Gyrodactylus sp.	17
Proliferative kidney disease	16
Costia sp.	9
Trichodina sp.	8
Ceratomyxa shasta	4
Scyphidia sp.	3
Fungus	
All fungal agents	31

PKD has been reported in Idaho and California as well as British Columbia. Further research and disease surveys will probably reveal that the causative parasite has a fairly wide distribution on the Pacific coast of North America.

Since many of the infectious diseases or agents have a wide distribution within the Pacific Region, managers of SEP facilities must continually be on guard to prevent serious losses. An effective diagnostic service is essential to the continuing success of these facilities. Research and early detection of causative agents will ensure release of healthy fish and further advances in disease control.

Contact: Gary Hoskins, Research Scientist, Fish Health and Parasitology Section, Pacific Biological Station, Nanaimo.

Ceratomyxa Shasta Study

This organism can be lethal to many salmonids; previous studies have been reported in the 1982 and 1983 annual reports. Researchers at the Pacific Biological Station proposed to continue investigations into the *C. shasta* problem in 1984 with routine seasonal sampling of smolts from the Fraser estuary. However, funding was approved too late to permit conducting any meaningful field studies in 1984. This study will proceed in 1985.

Contact: Leo Margolis, Head, Fish Health and Parasitology Section, Pacific Biological Station, Nanaimo;
Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Controlled Reproduction

The objective of this program is to develop new methods and improve existing methods for the controlled reproduction of salmonids so as to facilitate stock enhancement, increase the landed value of the catch and provide new options for the management of the fishery.

Controlled Sex Differentiation

The objective of this project is to develop methods of controlling sex in Pacific salmon, and more specifically, to develop the capability of producing sterile and all-female groups. A wide range of benefits will accrue from the successful development and implementation of sex control techniques as is evident from current pilot trials at SEP production facilities.

Production of All-female Stocks of Pacific Salmon

Research on the production of all-female stocks of Pacific salmon and the application of this technique at the production level in accordance with SEP objectives have continued with significant progress made in 1984. Current work is directed towards the enhancement of depressed stocks of chinook salmon. The primary objective for producing all-female groups of salmon is to increase the proportions of females in a stock, thus permitting rapid enhancement where brood stock availability is a limiting factor. Additional benefits will accrue from reduction of jack production, shifting the age distribution of the harvest where females are harvested in older age classes, and increasing the value of the commercial catch by providing a higher proportion of roe-bearing fish.

Milt from genetically all-female chinook salmon which had been converted into males and reared at the West Vancouver Laboratory was used to produce and release 100,000 female chinook at the Capilano hatchery in 1983-1984. A total of 320,000 all-female fish were produced in 1984 of which 220,000 will be released in 1986. The remaining 100,000 are being submitted to remasculinization treatments and will also be released in 1986. On their return to the hatchery, the latter fish will produce "female milt" to further increase the female/male ratio of future chinook hatchery production. The objective of the delayed release of these groups is to improve the ocean survival and to increase the return rate.

Birkenhead stock chinook which were the subject of a masculinizaton treatment in 1981 and held in captivity at the West Vancouver Laboratory will be used in the fall of 1985 to fertilize eggs at Birkenhead. This will result in a release composed of 75 percent female fish. The basis of this percentage is that half of the alevins treated with the androgen would have been males regardless of treatment and thus would produce normal milt. The other half of the treated alevins would have been females, their milt containing only female chromosomes, and would produce 100 percent female progeny.

Production of Sterile Pacific Salmon

The technique of sterilization is oriented to prevent or delay sexual maturation of selected salmon stocks and the anadromous migration which accompanies maturation. It is therefore mainly applicable to relatively abundant stocks or for intensive aquaculture. The benefits of the technique in connection with SEP objectives are:

- to redistribute harvest from hatchery to fishery
- to eliminate production of precocious males (jacks) which do not realize full growth potential
- to produce larger fish by extending the life span of fish that will remain in the ocean and continue to grow for one or two additional years
- to maintain "silver bright" quality year-round in resident stocks
- to raise the commercial value of wide-ranging species such as chum which deteriorate in quality as they approach subterminal and terminal fisheries.

Additionally, the release of sterile hatchery-produced fish could alleviate fishing pressure on wild stocks by providing "buffering capacity" and also eliminate the genetic impact of interbreeding between such a buffer of hatchery salmon and wild stocks.

Further to the pilot releases of 1981 and 1982 from the Capilano hatchery, additional production-sized coho sterilization treatments have been conducted in the following years from Capilano and Big Qualicum hatcheries. In 1984, 225,000 Capilano coho and 75,000 Big Qualicum coho were treated for release in 1985. At the Thornton Creek hatchery, 70,000 chum were sterilized and released each year in 1983 and 1984. Of the 1984 brood, an additional 70,000 coho salmon will be treated at both Capilano and Big Qualicum for release in 1986.

Recapture data from tagged sterile fish from the commercial and sport fishery and the near absence of these in the hatchery escapement indicate that major objectives of the sterilization program such as redistribution of the harvest from hatchery to fishery and production of larger size salmon in the fishery have been met.

Further monitoring and assessment of the sterile tagged releases regarding ocean survival and contribution to the fishery will continue.

Induced Ovulation and Spermiation

The development of methods for the control of final maturation and ovulation in females and spermiation in males provides a means of both advancing and synchronizing spawning. Advanced and synchronized spawning reduces or prevents prespawning mortality in suboptimal adult holding conditions in fresh or sea water and streamlining of hatchery procedures by efficient scheduling and reduced labor costs. In 1984, these techniques were used to assist production at the Conuma hatchery by inducing ovulation in coho prespawners by repeated $LHRH_a$ injections. Additional trials are planned for 1985.

Chromosome Set Manipulation

The use of chromosome set manipulation to control reproduction in Pacific salmon is currently under study. The induction of polyploids (triploids) and cloning by gynogenesis are considered promising techniques to produce sterile fish and for controlling sex ratios and maintaining superior genotypes, respectively. Triploids, fish having an extra (third) set of chromosomes can be artificially induced by applying hydrostatic pressure or temperature shocks to newly fertilized eggs. The triploid chromosome complement has the general effect, particularly in females, of inhibiting gonadal development.

Gynogenesis, applied to salmonids which have female homogametic sex inheritance, results in all-female offspring. The technique involves the inactivation of the paternal genetic contribution by irradiation and additional physical manipulation to restore the zygote to the viable diploid condition. Consecutive generations of homozygous gynogenetic fish would yield clones or highly homozygous individuals which could be used to preserve or enhance production characteristics such as growth rate.

In 1984, heat shock and hydrostatic pressure were used to produce triploid and gynogenetic coho and pink salmon. To enhance treatment effectiveness and triploid survival, studies will be conducted to monitor gonadal development and radioimmunoassay will be used to obtain profiles of plasma steriod hormones.

Contact: Dr. Ed Donaldson, Research Scientist; T.J. Benfey, Graduate Student; Fisheries Research Branch, West Vancouver Laboratory.

Salmon Genetics

The salmon genetics program was initiated in 1981 to study how natural populations of Pacific salmon are structured genetically, what the genetic impact of artificial production techniques might be, and to initiate selective breeding programs to support the Salmonid Enhancement Program and mariculturists. This research will help answer questions concerning:

- whether each spawning population of salmon is genetically unique or whether aggregates of populations can be managed as one stock

- what the genetic differences between hatchery-reared salmon may be
- whether the value of salmon catches or the manageability of salmon can be improved through genetic selection, i.e. animal breeding.

The Salmonid Enhancement Program has contributed funds to research on genetic variation (expressed as protein variability detectable via electrophoresis, a technique using electrical current to separate proteins of differing electric charge) within and between populations of chum and chinook salmon, and the heritability of growth traits in coho salmon. SEP has also contributed financially to the maintenance of genetic experiments at Rosewall Creek experimental hatchery.

The electrophoresis laboratory was highly productive in 1984 processing chum, chinook and sockeye salmon samples. Processing of some chum and chinook samples for SEP-related studies was delayed somewhat during the completion of a large-scale survey of genetic variation between sockeye populations. However, analysis of chinook collected from the upper Fraser and Thompson Rivers, and Quesnel hatchery will be completed in March 1985. Analyses of chum collected in rivers tributary to Tlupana Inlet (west coast Vancouver Island) and Conuma hatchery will be completed during spring, 1985. These latter two studies will evaluate genetic variation between local populations and will survey the effect of satellite hatchery practices on the genetic composition of donor stocks.

Proteins studied using electrophoresis are the product of one or very few genes and therefore many proteins must be studied to evaluate genetic variability in salmon populations. Conversely, other traits such as growth rate or body shape are believed to be regulated by many genes and such traits are referred to as polygenic. Traits important in animal breeding are frequently polygenic, and several such traits are currently being studied by the Genetics Unit. Of particular importance is the study of the genetic basis for red and white flesh production by chinook salmon. A genetic basis to this trait has been demonstrated, but approximately one and one half years remain before completion of this study. Other studies of polygenic traits include:

- comparisons of growth rates between several populations of both coho and chinook salmon
- assessment of the genetic and environmental determinants of early male maturity in coho salmon
- genetic selection for increased size at sexual maturity in coho salmon. The latter program is being conducted in collaboration with Quinsam hatchery and is in the second year of a six-year project (two generations of selection).

In 1985, the genetics program will continue to evaluate genetic variation between Fraser River chinook populations, will emphasize reporting of previous work, and will continue selective breeding programs for salmon. The program will become increasingly involved in brood stock management for mariculture and will strive to become more involved in restoration programs of remnant chinook populations.

A collaborative project with the parasitology program will investigate the genetic basis for coho and sockeye resistance to the blood parasite Cryptobia salmositica. The Unit will continue to refine the interpretation of genetic variability on Pacific salmon by studying variability in base sequences of mitochondrial DNA in pink and sockeye salmon.

Contact: Dr. Brian Riddell, Research
Scientist; Ruth Withler;
Pacific Biological Station,
Nanaimo.

Fish Nutrition/ Smolt Quality Program

During 1984, work on fish nutrition was directed to:

- preparation of primary and technical reports pertaining to past nutrition/smolt quality studies
- maintenance of strict quality control on fish food ingredients and finished foods used in B.C. hatchery facilities
- implementation of existing nutrition technology into the hatchery system.

The reasons for pursuing each of these goals include the following:

- excellent data have been obtained and recommendations made which, if implemented, will improve the cost effectiveness of hatchery salmonid production
- high quality foods are essential to ensure optimal growth, food conversion, health and ocean survival of salmonids
- premium diets are now available for culturing chinook, coho, and pink salmon and steelhead trout.

With respect to chinook and pink salmon, nutritional manipulations allow more complete realization of their growth potentials than is presently possible with conventional hatchery diets. Evidence indicates that large smolts (chinook) or fry (pink) have increased likelihood of survival in the wild. For coho salmon, which have a long freshwater residency, dietary manipulations permit minimum cost per kg of weight gain. This is important since food accounts for 40 to 50 percent of the hatchery operating expenses.

Three primary and six other reports were published. Two additional reports were accepted for publication, one of these in the Journal of Nutrition.

Approximately 20 to 25 samples (food ingredients and finished diets) were evaluated each month at the West Vancouver Laboratory with respect to proximate composition, lipid quality and vitamin C content. Moreover, good liaisons were maintained with Quanta Trace Laboratory (assess mineral levels), CANTEST (monitor selected vitamins) and SEP representatives. Potential problem areas were identified.

A large-scale nutrition study on chinook salmon was completed at Robertson Creek hatchery. A pilot scale study of similar design was also completed at Qualicum hatchery. Generally the growth and survival (fresh water) of fish fed the West Van 33 dry diet versus Oregon moist pellets (OMP) were comparable at each location, even though the initial water temperatures at Qualicum hatchery were less than 6°C. Chinook at Robertson Creek were differentially tagged and released. At the Campbell River estuary, juvenile pink salmon fed the West Van P-10 diet grew significantly faster than those receiving OMP. The fish were differentially marked and released to evaluate the influence of fry size on adult pink salmon returns.

Other activities of the fish nutrition group during 1984 included:

- conducting meetings and initiating talks with private industry to stimulate local fish food manufacture and thus reduce reliance on imported food
- investigating the feasibility of securing a source of high quality fish meal and oil for inclusion in hatchery foods. Currently these products are not always available and the use of inferior products can jeopardize salmonid growth, food conversion and health
- conducting a small-scale study on coho salmon at Chilliwack hatchery to compare the effectiveness of West Van 33 in moist form versus Oregon moist pellets. An Ontario firm agreed to manufacture WV33 in moist form, but due to shipment delays and the failure of the company to manufacture WV33 in accordance with specifications, this project was stopped.

The goals for fish nutrition work in 1985 are similar to those in 1984 except it is planned to determine when dietary lipid oxidation exerts adverse effects on the growth and health (resistance to infectious diseases) of juvenile chinook or coho salmon and to compare the nutritive values of fish meals prepared from underutilized species to that of herring meal for juvenile chinook salmon.

Contact: Dr. Dave Higgs, Research Scientist, Fisheries Research Branch, West Vancouver Laboratory.

Incubation and Water Quality

The objective of this research is to develop water quality standards, primarily for egg incubation, and to improve and standardize certain techniques used in salmonid hatcheries from egg and milt collection to first feeding of fry.

Mechanical Shock Sensitivity

Sensitivity of eggs to shock during manipulation or transport has been examined in the five Pacific salmon; a final study of steelhead trout eggs will be conducted shortly. Sensitivity varies in three intervals following fertilization. It is lowest in the first interval (0-60 min), intermediate in the second (1-24 hr), and highest in the third (from 24 hr until the eyed stage). After eyeing, sensitivity is very low. It is recommended that manipulation of fertilized eggs be restricted to the first 60 minutes following fertilizaton and, where possible, to the first 5 minutes of that period.

Sensitivity of eggs to shock also varies between species:

- for unfertilized eggs, sockeye, chinook, chum, coho, pink
- for fertilized eggs, coho is most sensitive to shock, followed by pink, chum, sockeye, chinook.

For practical use, the accompanying table shows eggs sensitivity in terms of maximum suggested "spill or pour height" (cm), beyond which spilling or pouring, or similar manipulation, may result in significant egg mortality.

Contact: John Jensen, Biologist; Dr. Don Alderice, Research Scientist, Pacific Biological Station, Nanaimo.

Temperature and Egg Development

Numerous attempts have been made to model the relations between temperature and rate of egg development in Pacific salmon. Most models provide reasonable estimates over part of the temperature range, but most also suffer from inadequacies at either or both ends of the range. Over 860 records of temperature and rate of development have been obtained for Pacific salmon and steelhead trout eggs from the literature, from hatchery records and from tests conducted to fill recognized gaps in temperature-development distributions. Use has been made of Schnute's "General Growth Model" as the best method yet found for fitting such distributions. Analysis of currently available data is

Table 42

Maximum Spill or Pour Height (cm)

Species	Unfertilized eggs	Fertilized eggs
Sockeye	12	20
Chinook	20	20
Chum	20	20
Coho	20	5-7
Pink	20	20

near completion. Equations for all species will be available shortly for hatchery use.

Contact: Frank Velsen, John Jensen,
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Alderdice, Research
Scientist; Pacific Biological
Station, Nanaimo.

Critical Dissolved Oxygen Levels

Critical oxygen levels are those below which lower oxygen supply interferes with rate of oxygen use. Critical levels provide an oxygen "floor" in hatchery incubators in relation to water throughput, loading rates, species, stage and temperature. Dissolved oxygen requirements are maximal just prior to hatch. Similar information for chinook and the other species of Pacific salmon will be made available as soon as analysis is complete. The objective of this work and that on temperature and rate of development is to provide a sound basis for computerized monitoring of incubation in hatcheries.

Contact: Dr. Peter Rombough,
University of Brandon,
Brandon, Manitoba; Dr. Don
Alderdice, Research
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Total Gas Pressure (Supersaturation)

Collaborative efforts involving contract work (L. Fidler, New Projects; P. Wright, Facilities Operations) and personnel and support from Fisheries Research, Facilities Operations, and the Kemano Completion Task Force has produced a new concept of the biological effects of atmospheric gas supersaturation on salmonids. In brief, there appear to be two types of gas bubble trauma (GBT) resulting from supersaturation: chronic GBT (range 104-105 to 109+ percent TGP) and acute GBT (range 110 percent or more TGP). The boundary between these two types of GBT varies between 108-115 percent TGP, depending on the levels of a number of ancillary variables acting simultaneously. A "sparing effect" (which raises the boundary TGP) occurs with lower temperature, larger fish size, higher O_2/lower N_2 ratio of gases in solution, and greater water depth. Chronic GBT (<110 percent TGP) results in low mortality (1-5 percent) over long exposure periods. Acute GBT $\overline{>}$110 percent TGP) produces rapid and high rates of mortality. It is recommended that TGP (%) levels be kept below 110 percent at all times and, if possible, below 104-105 percent most of the time. In hatcheries, provision of dissolved O_2/N_2 gas ratios at 1.0 or higher, and availability of deeper water (1 m or more), should reduce but not eliminate GBT problems if TGP levels rise into the chronic range.

Incubating eggs appear less susceptible to GBT than juveniles. Eggs have an internal (hydrostatic) pressure of at least 15 mm Hg two hours after activation. This increases to at least 25 mm Hg in 24 hours, and reaches a final internal pressure of 50-90 mm Hg prior to hatching, depending on the species. In shallow (e.g. Heath) trays, the 25 mm Hg internal pressure should allow tolerance of TGP levels up to 107-108 percent. Final internal pressures of 50 to 90 mm Hg will compensate for TGP levels of 106.8 to 112.3 percent. Eggs with the lowest internal pressure prior to hatching should tolerate 110-112 percent TGP in shallow trays without incurring mortality from GBT. However, TGP levels of 110-112 percent do produce sublethal effects in eggs. Therefore it is recommended that TGP criteria for juveniles be extended to eggs, while recognizing that the 104-105 percent TGP boundary for chronic GBT in the juvenile will be increased by a 6-7 percent excess TGP "cushion" in the egg stage. This cushion is eliminated as soon as hatching occurs.

Contact: Dr. Don Alderdice, Research
Scientist; John Jensen,
Biologist; Pacific Biological
Station, Nanaimo.

Low pH and Egg Incubation

A threshold pH for steelhead trout egg incubation, based on effects of acid waters on water uptake and internal pressure in eggs, is set at pH

6.6-6.7. This pH level is recommended in the development of B.C. salmonid species until further data on Pacific salmon eggs become available.

Contact: Dr. Peter Rombough,
University of Brandon,
Brandon, Manitoba; John
Jensen, Biologist; Pacific
Biological Station, Nanaimo.

Hatchery Water Quality Criteria

Penny Applied Sciences Ltd. completed two contract reports in 1984; one on further development of design analysis procedures for hatchery aeration systems, and another on the biophysical phenomena associated with gas bubble trauma. The first study was done for SEP Engineering, with some assistance from SEP Enhancement Operations. The latter study is part of a larger investigation undertaken jointly by SEP Enhancement Operations staff, contract work at Puntledge hatchery, the Incubation and Water Quality research program at the Pacific Biological Station, and research being carried out at the University of Victoria. The larger investigation, which also assists the Kemano Completion Task Force in its activities, provides:

- a new appreciation of the theory of gas bubble formation in the blood and tissues of fish (L. Fidler)
- a measure of the influence of low levels of dissolved gas supersaturation on chronic gas bubble trauma (GBT) (J.M. Shrimpton)
- a first understanding of the distinction between chronic and acute GBT, environmental factors that alter fish response to supersaturation, and new criteria relating the level of supersaturation to development of gas bubble trauma (D. Alderdice, J. Jensen and J. Schnute).

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations; Dr. Don
Alderdice, Research
Scientist, Pacific Biological
Station; John McNally, Senior
Implementation Engineer,
Engineering.

Mark Recovery Analysis

In 1984, considerable effort went into the task of computerizing coastwide data from the Mark Recovery Program. Unfortunately, due to the magnitude of the task and the limited available manpower, the data could not be compiled to a level sufficient for a definitive coastwide analysis. In the meantime, we undertook a pilot study investigating the use of the Mark Recovery Program as a tool for assessing the coastwide influence of chinook and coho salmon released from hatcheries. The study was based on certain data available in late 1984. It should be emphasized that these data were preliminary, incomplete, and subject to serious error. Indeed, a major part of the study involved identifying both the data requirements and the steps necessary to complete a more definitive analysis. When necessary in the pilot study, we used very poor quality data or even conjectured data based on available trends.

There are two distinct approaches to the analysis of mark recovery data. The first focuses on a group of fish released from an enhancement facility and follows the progress of the group through various fisheries in later years. The second focuses on a particular fishery and takes note of all the various groups that enter it. In this approach, assuming that all enhanced stocks can be traced with coded-wire tags, it is possible by subtraction to identify those "wild" or "natural" stocks not due to enhancement. Unfortunately, not all enhanced groups contain a tagged proportion, so that the analysis is forced to make potentially controversial assumptions about the behaviour and survival of unmarked enhanced fish.

As a result of the pilot study analysis, various tables and graphs were generated showing releases of fish by agency, survivals of hatchery fish into various fisheries, and catches by release agency. On a coastwide basis, it appears that survival of hatchery chinook is declining and that hatchery coho are steadily replacing wild stocks.

It should be emphasized that the great majority of enhanced stocks come from the states of Washington and Oregon and that coastwide trends are indicative primarily of the effects of U.S. enhancement. Further details on the pilot study are given in the report titled "The Mark Recovery Program as an Assessment Tool for the Hatchery Chinook and Coho Salmon Enhancement Program".

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Stock Interpretation Unit,
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Nanaimo.

Job Creation Projects

Stock Identification and Disease Sampling

Samples of juvenile sockeye taken at four sites in the Strait of Georgia in 1982, 1983 and 1984 were analyzed for the presence of naturally-occurring parasites. The system used ten parasite marker tags.

Stock identification would assist in predicting migration routes and the strength of returning adult stocks.

A survey for the presence of proliferative kidney disease (PKD) in ten hatcheries was conducted. Samples from 100 healthy and 100 infected fish were taken from each hatchery, and attempts were made to obtain samples of wild stocks of juvenile coho, steelhead and sticklebacks in each of the rivers.

The hatcheries/watersheds sampled were:

- Chehalis
- Chilliwack-Vedder
- Capilano
- Cowichan
- Campbell
- Nanaimo
- Stamp-Robertson
- Puntledge
- Big Qualicum
- Quinsam.

This project was also concerned with trying to determine the prevalence of IHN disease at Fulton and Pinkut spawning channels and trying to determine the causative agent of mortalities at Chehalis hatchery.

Research Assistance

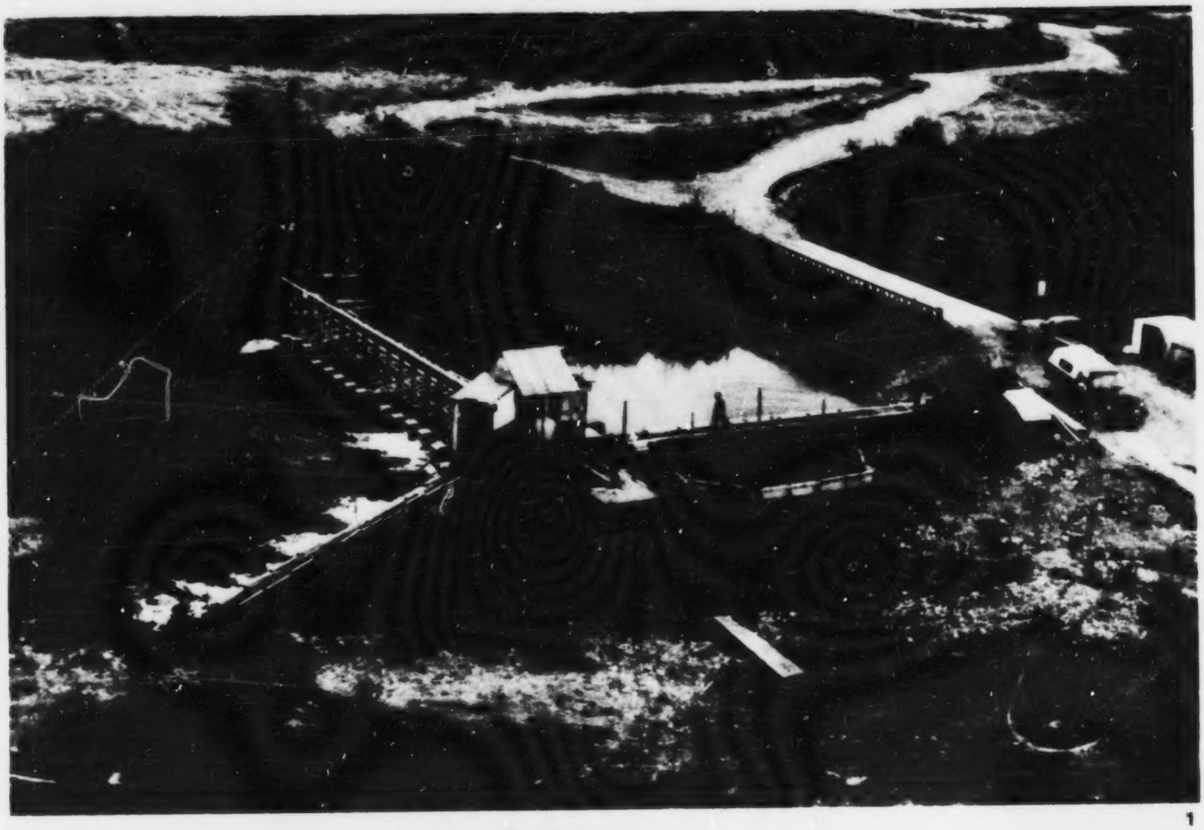
A job creation crew provided assistance to several projects conducted at the Pacific Biological Station in Nanaimo, including:

- stock sensitivity experiment
- growth response experiment
- seawater tolerance/challenge test
- TGP (total gas pressure analysis)
- electrophoretic sampling.

Fish Nutrition

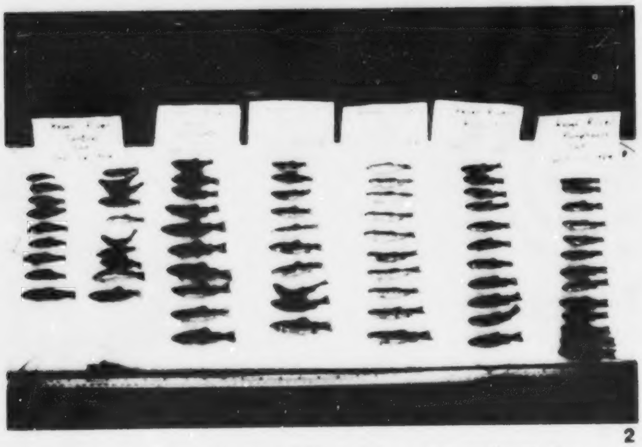
A job creation crew provided support to nutritional experiments at DFO's West Vancouver Laboratory.

Contact: Chris deHrussoczy-Wirth,
Head, Employment Development,
Special Projects Division.



1

1. The Keogh River fish fence has provided valuable information on steelhead survival and returns.



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2. These steelhead fry were sampled in control and downstream sites to assess impacts of inorganic fertilizer treatments.

Provincial Research

Keogh Pilot for Steelhead Enhancement

Research has been conducted for eight years at the Keogh River, an experimental steelhead stream on northern Vancouver Island. Several potential enhancement techniques, including instream enhancement, above-barrier stocking and net-pen culture in lakes, have been developed and evaluated. Biophysical modeling of steelhead smolt yield for application to small coastal rivers has been largely completed, and freshwater survival rates of wild and hatchery steelhead have been examined over several years. The final phase of experimental enhancement by development and evaluation of stream enrichment is ongoing, as is a detailed assessment of marine survival rates of both hatchery and wild steelhead smolts. Results of these studies, including freshwater survival, residualism of hatchery fish, instream enhancement and steelhead modeling, have been discussed in earlier annual reports.

Marine Survival of Hatchery Steelhead

Information about three years of returns of hatchery steelhead (reared in net pens at O'Connor Lake in the Keogh watershed is available because smolts and adults are enumerated through a counting fence located near tidewater. Returns are summarized in the accompanying table.

Preliminary results indicate that an upper river (11 km) release survived at 6 percent, compared to 8 percent for a lower river (0.3 km) group released in 1982. There was no significant difference in returns of fish released in the lower river compared to those towed into the ocean in pens and released approximately 2 km offshore.

Table 43

Steelhead Marine Survival from O'Connor Lake Net-Pen Facility

Year of Release	Size (g)	No. Released	Marine Survival (%)
1980	60	11,600	5.8
1980	45	3,400	5.1
1981*	103	3,000	3.1
1981	65	12,800	6.6
1982**	64	30,400	7.7

*reared 2 years

** incorporates preliminary data collected in 1985

Marine Survival of Wild Steelhead

Wild smolt yield and subsequent adult return at the Keogh counting fence from 1977 to 1984 has provided variable marine survival rates as summarized in the following table.

Table 44

Wild Steelhead Marine Survivals

Smolt Year	Smolt No.	Average Length (cm)	Survival (%)
1977	2,343	17.39	14.6
1978	2,104	16.04	8.6
1979	6,900	18.07	16.3
1980	5,500	16.20	9.0
1981	11,897	18.74	18.4

Functional components governing adult return were not only smolt number and size but also:

- the probability of males or females becoming an ocean age 2 or 3,
- by freshwater age
- by smolt size
- smolt sex ratios by size.

These size-related variables are being used in a model of adult steelhead run reconstruction.

Even- and odd-year cyclic patterns are evident in mean smolt lengths, survivals and in abundance of ocean age 2 or 3 adults. Size-adjusted survivals indicate very little difference in ocean survival rates between years. Ancillary to this work, traditional steelhead scale back-calculation techniques have been shown to require further research.

Adult returns to 1987 will continue to add to this data base; from that date onward, further returns will be affected by stream nutrient enrichment experiments.

Experimental Net-Pen Culture of Steelhead Smolts

Early in SEP, there was a need to develop more cost-effective techniques for steelhead smolt culture. Research and development at O'Connor Lake, in the upper Keogh watershed, was designed to:

- determine if smolts could be reared in 10 months and at a consistent mean size of greater than 60 g
- determine effects of rearing density on fry to smolt growth, quality and rate of marine survival
- examine effects of feeder designs and feeding frequencies on growth and quality
- resolve operational constraints, including high summer temperatures, winter ice formation and predation
- release smolts at various experimental stocking locations
- contribute to steelhead production targets in the area.

During 1984, smolts were produced for three rivers on northern Vancouver Island. Keogh and Quatse production exceeded and met targets, respectively, while Tsitika summer steelhead were well below target owing to a shortage of brood stock. Mean weights ranged from 67 to 88 g for all groups. Returns of an earlier release of Tsitika stock to Campbell River created a significant fishery at Campbell River in 1984.

Total production of smolts in 1984 at the O'Connor Lake facility demonstrated that a net-pen facility in a suitable lake, similar to O'Connor, can be operated on a cost-effective scale. Return rates have also been high compared to conventional hatcheries. The research phase was completed in 1984 and the facilities are operated under contract by the North Vancouver Island Salmonid Enhancement Society, for early coho rearing and for steelhead smolt culture.

Stream Enrichment

Stream enrichment research and development has been conducted provincially since 1981, when a pilot experiment in an upper 2 km stretch of the Keogh River demonstrated that additions of inorganic nitrate and phosphate greatly stimulated periphyton growth. The food chain of coho salmon and steelhead trout was enhanced, leading to a 50 percent to 100 percent increase in average fish size after 2.5 months. Further trough tests and assessment of a low release fertilizer led to a "whole stream" application in 1983 which failed owing to nutrient release rates that were too rapid. Under contract, application of dispersed conventional fertilizer to 80 percent of the river was successfully completed in 1984. Ten percent was also treated with slow release materials, and a further ten percent was retained as a control. In May, after two weeks of fertilization, periphyton accumulation increased 5 to 8 times the levels in the control.

Table 45

Steelhead Smolt Releases

Stock	Stocking Site	Smolts Released	Comments
Keogh[1]	Keogh	37,500	- early run, late run - early X late run - high and low quality groups
Quatse[1]	Quatse	12,000	- early run, late run
Tsitika[2]	Campbell	5,500	- to establish a summer run in Campbell River
	Total	55,000	

[1] Winter Steelhead
[2] Summer Steelhead

Growth rates of juvenile salmon and trout in the treated areas were improved significantly, particularly in the fry stage. Enumeration of smolt yields in 1985 and 1986 are necessary to determine if growth increments and increases in juvenile density will increase smolt yield and/or size at smolting.

Fertilization and monitoring was done under contract. Further testing of slow release fertilizer was successfully completed. Comparisons of cost demonstrated that a few mechanical dispensers are more effective, and they effectively fertilize extended stream sections (e.g. 5-10 km). During 1984, considerable progress was made in analyzing data collected in 1981 and 1984. Results of measurements of water chemistry, periphyton accumulation, insect abundance, diet of salmonids, and fish growth are summarized in a report to be submitted by the consultant in 1985.

Further Investigations

Intensive research at the Keogh River will continue until the returns of experimental smolt groups are completed in 1987. Evaluation of the response of coho and steelhead smolts to stream enrichment will also require an additional three years of evaluation.

Contact: Pat Slaney, Senior Research Biologist; Bruce Ward, Fisheries Biologist; Bill Harrower, Fisheries Technician, Fisheries Branch.

Program Development and Bio-economic Evaluation

Regional Planning and Economics Branch

Resource Management Plan and SEP Continuation Planning

The main focus of the Planning and Economics Branch in the last quarter of 1984 was the Salmon Resource Management Plan. This work began as an exercise to determine the impacts of rebuilding natural stocks using altered fishery management plans in isolation. As anticipated, this approach identified those areas of the coast in which SEP would be the only way to increase runs, areas in which SEP could support rebuilding of natural stocks and the areas in which SEP could be a deterrent to natural stock rebuilding. With this background work in hand by 1985, the region was in an excellent position to develop an integrated enhancement and management proposal which would substantially increase productivity of both wild and enhanced stocks.

Concurrent with these activities, the group completed new wholesale price forecasts for salmon, new estimates of marginal harvesting and processing costs, and estimates of the investment behavior of fishermen.

As part of the SEP continuation submission, an analysis of Phase I was completed using the improved benefit-cost model. Applying the same assumptions that were used in earlier analyses of SEP (no Canada-U.S. agreement, no capitalization, with shadow pricing) SEP was seen to perform well in terms of economic criteria, yielding $143 million in net economic benefits at a benefit-cost ratio of 1.48:1. The rank ratio, showing the net benefits (total benefits less associated costs) per dollar of government expenditure, also indicates that Phase I is a sound investment of public funds at 1.6:1. This compares favourably with the earlier analysis of SEP Phase I which estimated the net benefits to be approximately $130 million at a benefit-cost ratio of 1.35:1.

The economic analysis is sensitive to the three assumptions listed above, i.e., without an international agreement, without capitalization of profits by fishermen, with shadow pricing of labour. If these assumptions are changed one by one in a cummulative fashion the value of the various economic criteria will change.

The Canada-United States Agreement, reached in 1984, improves the economic performance of Phase I, raising the net economic benefits to $153 million at a benefit-cost ratio of 1.5:1. The Rank ratio is 1.65:1.

One of the most important assumptions of the analysis is that induced investment by the fleet will be controlled. If controls are not implemented and capitalization of profits occurs, the net economic benefits of SEP Phase I are $106 million. The benefit-cost ratio is 1.3:1 and the Rank ratio is 1.37:1. SEP is a much more attractive public investment when capitalization is controlled, but even with no fleet rationalization, SEP Phase I performs well on economic criteria.

If the job creation aspects of Phase I are ignored and labour inputs are not shadow priced, the net economic benefits of SEP are $83 million dollars at a benefit-cost ratio of 1.23:1. The Rank ratio is 1.29:1.

Studies and Reviews

A number of studies and reviews were undertaken in 1984.

a) Biostandards

A major review of the biostandards was undertaken in 1984. This project was completed by midyear and resulted in an up-to-date version of standards used for enhancement work. It was a disappointment, however, that after approximately 10 years, the data base for wild stocks had not improved enough to justify any additions to the data base. Therefore the revised enhancement figures were published and the information stored on computers. It is the opinion of this branch that little effort should be directed at upgrading wild stock information until such time that more field information is available.

b) Juvenile Stock Interaction

This study involved a review of available literature and information on the interactions between cultured and wild stocks of juvenile salmonids. Available literature, both published and unpublished, was reviewed in order to identify areas of concern to planning and development of enhancement/management strategies. Summary of results include:

- in many instances coho releases may pose serious problems. Under some conditions coho may prey very heavily on other juvenile salmonids. They can also be very aggressive and may displace wild coho or other species
- major problems with chinook include competitive interactions among fry. This is shown to be density-dependent, and may involve steelhead in freshwater habitats and chum in estuarine habitats as well as other stocks of chinook
- little information was found relating to sockeye. Because of the nature of the enhancement technology used for sockeye, many of the interactions are no different than in wild stocks
- chum fry are heavily preyed upon by coho, steelhead and cutthroat smolts. Timing and size of release can be used to alleviate this. Chum fry are also affected by other chum stocks, pink stocks, and possibly, chinook
- pink fry are also susceptible to predation by coho, steelhead and cutthroat smolts. Timing and size of release can be employed to a limited extent to alleviate this. Pink fry fare poorly in competition with chum fry
- steelhead may compete with rearing coho and chinook. Size differences can be used to minimize this. Older steelhead may prey upon pink, chum and sockeye fry, although they are usually not present in sufficient numbers to have an impact. Cultured steelhead may have negative impacts on wild populations where larger fish dominate and displace the wild fish of the same age class. They may also revert to parr and remain in the stream, competing with wild resident fish
- cutthroat fry appear to be easily disrupted and displaced by coho or steelhead fry. Cutthroat tend to favour higher gradient areas, and this can be used to prevent disruption. Cutthroat smolts have been observed to prey on coho, chinook, sockeye, chum and pink fry. Time of release can prevent or reduce this. Cutthroat are also subject to residualism.

c) Evaluation of Pulse Fertilization

At the present time, enrichment of sockeye is carried out at several B.C. coastal lakes annually. Based on a study that showed adult growth of sockeye was reduced when total ocean abundance was high, it was suggested that annual fertilization might not be an optimum strategy. It was hypothesized that when peaks of Alaskan sockeye populations mixed with B.C.'s lake enriched stocks, the positive impact of fertilization would be dissipated through reduced adult sizes and subsequent value of commercial catches. Pulse fertilization was proposed as an alternate strategy to optimize the economic benefits of lake fertilization.

Under a pulse strategy, lake fertilization would only be undertaken when juvenile B.C. sockeye populations were predicted to mix with Alaskan sockeye populations at their off-peak ocean rearing levels. A computer model was developed to calculate the value of this strategy versus annual fertilization. The model varied the cost of fertilizing a lake, the incremental number of enhanced sockeye produced, the wholesale value and the number of Alaskan sockeye in peak years.

The study found that pulse fertilization was not a better technique than annual fertilization. Although the adult size of fertilized fish was reduced in peak years of Alaskan sockeye abundance, the increased number of B.C. sockeye due to fertilization more than compensated. Pulse fertilization was economically better only in extreme cases where lake fertilization became exorbitantly expensive (i.e. treatment costs increased to $1.5 million from $85 thousand), incremental increases of sockeye from fertilization were small, wholesale value declined dramatically, and Alaskan peak sockeye abundance reached unprecedented levels.

d) Effects of Gulf of Alaska Sockeye Abundance

Two reports were prepared from historical data for catch and escapement from six B.C. and ten Bristol Bay (Alaska) sockeye stocks. The data were used to calculate total sockeye abundance in the Gulf of Alaska from the early 1950s to the mid 1970s. Marine survival rates, adult body sizes, growth rates, and age at maturity were examined in relation to total sockeye abundance to determine density dependent effects.

The first report documents how the data were reconstructed to give ocean abundances at different life stages and outlines the detailed findings of the study. The second report briefly summarizes the major findings.

The data were segregated into four different time periods for the ocean going phase of the sockeye life cycle to determine if and when density affects sockeye. Ocean densities had no apparent effect on either marine survival rates or age at maturity. It was found that high levels of ocean sockeye abundance were associated with losses of 10-22 percent of potential adult body weight. The most pronounced impact of density on growth occurs in early ocean life, most likely due to competition for food. This finding has implications for future management and enhancement of B.C. sockeye stocks.

e) Historical Trends in B.C. Salmon Catch and Production

This report represents a first attempt at estimating the commercial catch of each Pacific salmon species, in numbers and weight, for subdivisions of the British Columbia coast during the earliest years of the commercial salmon fishery. The source data for years prior to 1930 were published statistics on the amounts of canned, salted, fresh/frozen, smoked and other salmon products produced at various localities on the British Columbia coast. From 1930 to 1946, the commercial catch of each salmon species, in hundredweight, was available for most of the present B.C. Statistical Areas in an unpublished report prepared by Wickett (1963). The results must be considered preliminary at present and more work is underway to check and refine the data.

f) Summary of Historic and Future Information by Country

This project was initiated to summarize data on the historic levels of production, with particular emphasis on production in Pacific Rim countries; to speculate on potential levels of future production, both from natural productivity and enhancement opportunities; and to assemble information and salmon management and enhancement plans of individual salmon producing countries. This report presents catch data by country and by year for Pacific salmon; and estimates the production by country of origin, which involves an analysis of interception problems, assessment of the natural stock, and appraisal of enhancement possibilities.

This study was undertaken in the belief that it would provide a useful perspective of the place that Canadian salmon production held in the past and holds at present on the world scene. It should also provide some insight into potential levels of production from the stocks under essentially virgin environmental conditions.

g) Coho Production for Expo 86

As mentioned in the 1983 report, the Department increased its coho production in hatcheries around the Gulf of Georgia in anticipation of increased numbers of anglers during the fair. It was also decided that all coho in hatcheries around the Gulf would be fin-clipped. This would allow fisheries scientists the opportunity to evaluate the contribution of hatchery coho to the fishery and would also permit the evaluation of a clipped-only fishery in which all unmarked (i.e. wild) fish are released. The basic intent of such a scheme would be to conserve wild stocks while increasing the take of hatchery stocks. Further analyses and discussions will be undertaken in 1985 prior to the 1986 fishing season. It is expected that a variety of DFO advisors would be asked to comment on such a scheme prior to its implementation.

Contact: Harold Swan, Associate
Director, SEP.

Maintenance of Major Facilities

Clearwater River Hatchery

In 1984, work was carried out on the existing hatchery building, pumphouses, aeration tower and intermediate rearing facility. Work included the structural, mechanical and electrical components for the hatchery building and also the mechanical and electrical systems for the site.

Chehalis River Hatchery

The hatchery release channel contained enormous sand and silt deposits that were difficult to remove due to permanent rock and concrete weirs blocking the exits. These weirs were breached and concrete walls with stoplog guides were built. By placing stoplogs into the guides, the water level upstream of the weirs was raised back to its former level. The stoplogs can be removed periodically to flush out accumulated sand and silt.

Robertson Creek Hatchery

A 900m^2 extension to the existing workshop was completed to expand and separate the woodworking and machine shop areas.

A review of the hatchery's electrical system was also undertaken by Emco Engineering, electrical consultants. A number of items, such as the alarm system, safety, and compliance with code items, have been identified for upgrading. This will be done in 1985.

Tlupana Inlet Conuma Hatchery

In 1984, two new wells with a combined capacity of 190 L/s were drilled to supplement the existing groundwater supply of 180 L/s. This total of 370 L/s will sustain full capacity and allow for some added capacity in the future. In conjunction with the new groundwater supply, two vertical turbine pumps complete with electric motors and right angle drive standby diesel engines were installed in concrete block pumphouses. Additional water distribution piping and a reinforced concrete aeration tower were also constructed.

Other work carried out in 1984 included:

Blaney Creek Fence - Rebuilt wing walls

Conuma River Hatchery - Repair alarm system

Chehalis River Hatchery - Installed 203 mm diameter flush valves in the aeration tower

Pinkut Creek - Tunnel inspection

Capilano - Diffuser grating Waterproof concrete.

Contact: John Beyer, Sr. Engineering
Technician, Engineering.

Regional Housing Program

A fishery officer residence was constructed in Masset on the Queen Charlotte Islands and a combined residence and office building was constructed at Nass Camp, 100 km north of Terrace.

Salmon Services

The Salmon Services Unit receives funding from the Field Services Branch, the Salmonid Enhancement Program and the Fisheries Research Branch to conduct the province-wide Mark Recovery Program and to operate the Regional Scale Laboratory. The Unit collects data on the age, species, size, and origin of salmonids and recovers coded-wire tags, Petersen discs, Floy tags, and multiple fin-marks from B.C. salmonid fisheries.

Mark Recovery Program

The goal of the Mark Recovery Program (MRP) is to randomly and representatively sample 20 percent of the Canadian commercial troll and net fisheries for adipose-marked coho, chinook, and steelhead. Effort is also directed at selected fisheries anticipated to contain coded-wire tagged chum, pink, and sockeye or fin-clipped chum and pink. During sampling, salmonids from individual boats are counted and checked for missing fins. The marked fish are removed, their length and weight are recorded and a scale sample is taken. The heads of adipose-only fish are retained for dissection.

Sport fishermen are requested to submit heads from adipose-clipped salmonids to an extensive network of head depots located at DFO offices, marinas, and tackle shops. Participating anglers receive information on their marked fish, a Salmonid Head Recovery Program button, and a Recovery summary newsletter. They are also eligible for one of eight prize draws held throughout the year. The depots which issued the winning labels also receive cash prizes.

The heads are dissected at the MRP Head Laboratory to recover the coded-wire tags. The decoded tag information is matched to the recovery data and entered by data processing staff in Vancouver into the MRP database on the VAX computer located at the Pacific Biological Station in Nanaimo.

In addition, the MRP Head Lab processes escapement heads for many of the hatcheries. In 1984, 2,830 escapement heads were processed. Beginning in 1985, historical escapement data will also be entered into the MRP database. Fisheries Research Branch enumeration projects submitted 2,284 smolts for processing by the Head Lab. Heads were also processed from a shaker study and from the troll logbook and observer programs.

In 1984, 1,343,818 salmonids were examined in the commercial catch by samplers stationed at Steveston, Vancouver, Namu, Prince Rupert, Port Hardy, Tofino, Ucluelet, Winter Harbour, and Campbell River. Of the fish sampled, 23,431 were adipose-clipped and 1,573 were multiple fin-clipped. The number sampled was 40 percent higher than the number sampled in 1983, partially due to large coho catches off the west coast of Vancouver Island. The addition of samplers stationed in Winter Harbour and Masset increased the sampling rate on northwest Vancouver Island and northern catches. An increase in the tag incidence of northern catches was also noted. This increase has been noted in recent years, as more northern hatcheries begin production.

The program expects to receive about 8,800 heads from sport-caught salmonids for 1984. This number is down 21 percent from 1983 and is similar to the number of recoveries received in 1982. Five depots set up in 1984 on the Queen Charlotte Islands increased participation in the program for the northern region.

MRP has begun using the VAX computer located at the Pacific Biological Station to process the data and generate reports. Historic data (1974-1983) is being converted to a standard format in the data base, with computations consistent for all recovery years. At present, data for 1979-1983 recovery years is available. Preliminary data for 1984 can also be accessed. The 1982 Annual Report (Canadian Data Report 454), published in 1984, is the final report of its kind to be published by the MRP. Facilities to directly access the data will be made possible by the new data base via report generation programs. Standard interim reports are now available while the proposed user reports are being completed. These reports have made MRP data both timely and accessible to users as well as tailored to meet individual needs.

The MRP also coordinates information from Petersen disc and Floy tagging programs and keeps a record of each tagging project. Fishermen returning tags receive a letter detailing the project to which their tags were applied.

The third year of the International Salmon Tagging Program took place in 1984. The program, under the direction of the Fisheries Research Branch, is designed to estimate interception rates by Canadian and U.S. fisheries on salmonid stocks originating from northern British Columbia and south-eastern Alaska. Approximately 52,000 pink salmon in Canadian waters were tagged with bright orange Floy spaghetti tie-on tags. Incidental catches of 1,200 chum and 200 chinook were also tagged. Similar numbers of each species were tagged in Alaskan waters. Voluntary returns of tags by sport and commercial fishermen, plus recovery of tags during sampling of the catch and escapement in Canadian waters exceeded 10,000.

Other tagging projects included Petersen disc tagging of coho at Birkenhead River, of chum and coho at Chilliwack River, of chinook on the upper Fraser River, and of coho at Lang Creek. Several projects applied unnumbered Petersen baffles, for which returns are not required.

The MRP office stores an inventory of Petersen discs and coded-wire tags. All requests for tags should be made to the program. Addressed postage-paid envelopes are also available for the return of Petersen discs and Floy tags.

Contact: Margaret Birch, Chief, Salmon
Services Unit.

FISH Microcomputer System

The development of a computerized data management system for hatcheries has been underway since 1980. The system operates on Apple II microcomputers and utilizes a package of programs known as FISH (Fishculture Information System for Hatcheries). These programs were developed by Enhancement Operations biologists and are now largely complete.

The FISH program package consists of data management programs for juvenile and adult fish, and utility programs for statistics, modelling fish growth, calculating gas solubility and other hatchery applications. There is also a comprehensive disease treatment program whereby the user can select any of 24 fish diseases for which the program will supply suitable treatments, notes treatment chemicals and calculations necessary for the administration of correct dosages.

There are 14 hatcheries in B.C. now equipped with microcomputers. Plans are to purchase and place two more Apple II microcomputers in 1985. Training sessions and custom programming are ongoing at each facility. Extensive documentation has been prepared and will be published in the near future.

Contact: Anne Kling, Bio-Program
Systems Administrator,
Enhancement Operations.

Surplus Egg and Fish Sales

Adult fish and eggs which are surplus to hatchery production requirements are available for sale or research purposes to other groups or individuals.

In 1984, some 3.8 million surplus eggs were supplied to commercial aquaculturists, community development groups, and researchers. Of this egg total, 2.8 million were provided to commercial aquaculturists at a cost of $10 per thousand for green eggs and $14 per thousand for eyed eggs. The remainder went to researchers and public involvement and community development programs free of charge.

Surplus adult sales in 1984 included approximately 298,500 kg of fish, with 36,523 adults supplied to the Qualicum band as food fish. The price of surplus fish was dependent on the fish quality.

Total revenue generated by surplus egg and fish sales in 1984 was $185,250.

Contact: Carol Cross, Assessment Biologist, Enhancement Operations.

Feed Quality Control Program

Enhancement Operations, in cooperation with the West Vancouver nutrition research group, continued to monitor the chemical quality of fish feed destined for use by SEP facilities in 1984. The program was designed to allow sampling of ingredients and finished feed at the manufacturing site, with subsequent chemical analysis in Vancouver. Analyses were carried out under contract by Can-Test Ltd. and Quanta Trace Laboratories.

Feeds and meals were routinely analyzed for proximate and mineral composition. Additionally, levels of vitamins A, E, C and B_2 were measured in the feeds. The quality of marine oil used in the feed was also monitored by determining free fatty acids levels and peroxide values. To ensure that any problems in feed quality were quickly identified and that only acceptable feeds were sent to SEP facilities, analyses results of critical quality control parameters were supplied to the Scientific Authority within 4-7 days of sample receipt and detailed analysis made available within 10 days. All results are stored in an Apple computer program.

The Fish Inspection Laboratory determined the microbiological quality of a few lots of feed using the Standard Plate Count method, determining levels of Escherichia coli and determining the presence or absence of Salmonella in the event that future microbiological specifications for feed were required. There was some concern when Salmonella was found in some samples, but investigations in cooperation with scientists from Pacific Biological Station indicated that there was not a public or fish health risk.

From this data, biologists were able to monitor critical components of feed and respond rapidly if any problems arose. As well, desired levels of vitamins, minerals and proximate components could be specified in the upcoming feed manufacturing contract. The program will continue in 1985 but at a reduced level.

Contact: Carol Cross, Assessment Biologist; Diane Plotnikoff, Feed Quality Control Coordinator, Enhancement Operations.

EPIC—SEP Phase I Data Base

The EPIC (Enhancement Planning Information Control) data base is an information management system. EPIC, developed for annual planning/evaluation exercises, maintains a centralized and comprehensive documentation of SEP's expenditures and salmonid production and provides flexibility to meet changing information demands. EPIC has both planned and actual project-specific fish production and budget information as well as operational and site descriptions. Fifteen different preformatted data reports are now available through a simple access procedure.

In 1984, the EPIC Systems Group transferred to the SEP Operations Bio Program Unit, changing its priorities to salmonid production reporting and evaluation.

During 1984, EPIC reports were prepared in response to over fifty information requests from senior government, SEP management, Regional and SEP Planning and a variety of users within DFO. Additionally, EPIC reference reports were used to answer numerous ad hoc information queries.

Plans are in the works for "uploading" and "downloading" capabilities for an EPIC-Apple Microcomputer linkage as well as a revamp of EPIC in coordination with the Regional Planning "Production Model" economic analysis programs.

Contact: Rosemary Pogue, Acting
Systems Coordinator, SEP
Facilities Operations.

Hatchery Water Quality Criteria

Penny Applied Sciences Ltd. completed two contract reports in 1984; one on further development of design analysis procedures for hatchery aeration systems, and another on the biophysical phenomena associated with gas bubble disease*. The first study was done for SEP Engineering, with some assistance from SEP Enhancement Operations. The latter study is part of a larger investigation program undertaken jointly by SEP Enhancement Operations staff and the Incubation Research Group at the Pacific Biological Station.

* See also Total Gas Pressure (Supersaturation) section under Incubation and Water Quality in Federal Research section of this annual report.

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations; John McNally,
Sr. Engineer, Engineering;
Dr. Don. Alderdice, Research
Scientist, Pacific Biological
Station.

Manageability Studies

The Management Biology Unit undertakes various studies and activities funded through SEP to provide biological input to the planning, design and implementation phases of the program.

Twenty-six studies were funded or partially funded by SEP.

South Coast

a) West Coast of Vancouver Island Chum Salmon Report

A report on the stock status of West Coast Vancouver Island chum salmon stocks was prepared in 1984. The report presents a historical perspective on catch, escapement and productivity of chum salmon stocks and discusses management potential for these stocks. It is anticipated that a manuscript report will be published in March 1985.

Contact: Steve Heizer, Management
Biologist, South Coast
Division, FSB.

b) Somass Chinook Reconnaissance

This study was conducted to estimate numbers and determine biological characteristics of the Indian food fishery catch on the Somass/Robertson Creek system on the West Coast of Vancouver Island. Although catches of other species were noted, the main objective was to obtain information on chinook salmon to improve the overall understanding of chinook salmon stock status in these systems and of the contribution of Robertson Creek hatchery chinook to the catch. The study was contracted to the Sheshaht and Opetchesaht Indian Band Councils. Effort and catch were estimated throughout the fishing season. Marked fish were counted and sex, length and scale data were taken from a subsample of the catch. The food fishery was open for four 24-hour periods in September. The total catch was estimated at approximately 13,000 chinook salmon, 800 coho salmon, 100 pink salmon, 100 sockeye salmon and 100 steelhead trout. The chinook salmon population had a higher proportion of males (58 percent) than females (42 percent). Age composition determined from a sample of 42 fish was predominantly four-year-olds (50 percent), with 28 percent three-year-olds, five percent five-year-olds and 17 percent jacks. A total of 845 chinook salmon were sampled for length. Mean length of females (83 cm) was greater than the mean length of males (79 cm). Male lengths were likely biased by the high proportion of jacks in the population. Only one chinook salmon with a missing adipose fin was recovered in the fishery. This preliminary analysis indicates that a low proportion of marked fish were intercepted in the native food fishery. A report recommends criteria for future studies.

Contact: Steve Heizer, Management
Biologist, South Coast
Division, FSB.

c) Barkley Sound Sport Creel Survey

In 1984, a saltwater sport creel survey was conducted in Barkley Sound and Alberni Inlet (Area 23). The study was conducted to provide data on returns of Robertson Creek chinook salmon stocks. It was of a similar design to the Strait of Georgia sports creel survey. Interviews at landing sites and overflights which were stratified by time and area provided the data.

Sport fishing effort, catch per effort and total catch were estimated for each strata. Analysis and report preparation are underway. The report will be available in 1985.

Contact: Tom Shardlow, Management
Biologist, South Coast
Division, FSB.

d) Pink Salmon Electrophoretic Program

Pink salmon were sampled from mixed stock fisheries in Johnstone Strait and nine pink salmon spawning streams. The purpose of the study was to determine stock compositions of Johnstone Strait even-year pink salmon in mixed stock fisheries. Electrophoretic analysis has proven to be an effective method of stock separation for chum salmon and can be used to determine interception rates in mixed stock fisheries. Samples of muscle tissue, eye, heart, liver and meristic data were taken from a total of 1,200 pink salmon. Of these, 350 were from mixed stock fisheries and 850 were from nine spawning streams primarily on the east coast of Vancouver Island and the mainland. Final analysis of stock compositions will be completed by June 1985.

Contact: Al Gould, Management
Biologist, South Coast
Division, FSB; Dr. Terry
Beacham, Research Scientist,
Pacific Biological Station.

e) Johnstone Strait-Fraser River Chum Catch Data Analysis

In 1984, the historic commercial catch and effort data (1970-1984) for Johnstone Strait/Fraser River chum salmon stocks was analysed for the purpose of stock reconstruction and estimating harvest rates. The results were consolidated into a "clockwork model" of Johnstone Strait/Fraser River chum salmon management. This clockwork model is a set of rules to dictate various harvesting strategies and will be in place for management during the 1985 fishing season.

Contact: Al Gould, Management
Biologist, South Coast
Division, FSB.

f) Johnstone Strait Chinook Catch Verification Program

This program involved the in-season field verification of chinook salmon catch by gear type in Johnstone Strait. Generally, chinook catches calculated in-season have substantially deviated from those which are calculated post-season from sales slip data. There is evidence that the sales slip data may be misrepresentative of actual catches, since some chinook catches are not reported.

Sales slips were reviewed, edited and compiled locally to ensure that sales slips match with fleet size for all gear types. Incorrect slips were reviewed with processors for correction, catch and effort data were verified, anomalies were identified and vessels which target on chinook were identified for closer scrutiny the following week. A computer model was designed and tested with 1984 data. The objective of the study is to correct chinook catch information in-season in the field, rather than at a removed location. The model will be complete in March 1985.

Contact: Al Gould, Management
Biologist, South Coast
Division, FSB.

NORTH COAST

a) Area 8 Test Fishery

A pilot test fishery was conducted in the upper Dean Channel, (above Area 8-8) from the end of June to mid-August 1984. The fishery targetted on sockeye salmon during July and chum salmon during August. Several sites were sampled to determine the feasibility of estimating escapements from test fishery catch-per-unit effort. Results of the study indicate that the test fishery can be used as an indicator to make in-season estimates of escapement. Since the test fishery is an improved method for estimating stock abundance and separating stocks, it should continue to be used as a tool for management, especially since expected returns to Snootli Creek hatchery could compound the difficulties of mixed stock management in Area 8.

Contact: Paul Sprout, Sr. Management
Biologist, North Coast
Division, FSB.

b) 1980/1981 Tagging Study Reports

In 1980 and 1981, pink and chum salmon tagging studies were conducted in Fisher Channel and Fitz Hugh Sound in Area 8. The objective of the study was to determine migration timing from outside to inside the fishery. Timing information is useful for management purposes, since it indicates the period that the fish are exploited by the fishery. Analysis and reporting of the results from these studies was contracted to a consultant in 1984. A manuscript report is expected to be published in June 1985.

Contact: Dave Peacock, Management
Biologist, North Coast
Division, FSB.

c) Morice CWT Recovery

Wild chinook salmon juveniles from the 1975 to 1979 brood years in the Morice River (Skeena system) were marked with an adipose fin clip and tagged with a CWT. Recoveries have been reported from various Alaskan and Canadian fisheries as well as from spawning ground surveys. In 1984, spawning ground recovery effort was continued and biological characteristics (age, sex, length) of fish were collected. Daily river boat surveys were made on the upper five km of river in the major chinook spawning area. Occasionally the survey was extended to include the upper 15 km of river from Morice Lake to Gosnell Creek. Helicopter surveys indicated chinook carcasses were distributed over the entire 37 km of river from Morice Lake to Lamprey Creek. A total of 397 carcasses, including four marked fish, were recovered from an estimated escapement of 4,000 chinook salmon to the Morice River. Tags are being analysed to determine year of marking. Most chinook salmon spawners in the Morice River are four-year-olds (12 percent or five-year-olds (62 percent). The information from these marking studies will be used to estimate survival and exploitation rates.

Contact: Les Jantz, Management
Biologist, North Coast
Division, FSB.

d) Cumshewa Inlet Test Fishery Data Analysis and Review

In 1982, a test fishing and tagging program was conducted in Cumshewa Inlet near Moresby Camp on the Queen Charlotte Islands. The purpose was to investigate the feasibility of using catch per unit effort (CPUE) data and mark recapture sampling techniques as a means of assessing chum salmon stock abundance in the Inlet for management of the proposed commercial chum salmon fishery in Cumshewa Inlet. There were three separate components to the 1982 study;

- gillnet sets at various locations around the inlet to estimate catch per hour
- sequential mark recovery experiment using tags applied to seine caught fish
- secondary tagging using spaghetti tags applied to fish caught in gillnets and recovered in various freshwater locations.

Analysis of the 1982 data and preparation of the report was completed in 1984. The report concludes that standard gillnet sets provide a good means of monitoring the run, although the 1982 data only provides a single set of data points for an index of abundance. The report also includes recommendations on future test fishing for effective management of Pallant Creek hatchery returns.

Use of standard gillnets should be continued with sets made every day at one chosen site and the mean catch for each week used as an index. Conglomerate Point was identified as the most favorable sample site because of high catch rates and since it primarily contains Pallant Creek fish; a tagging program should be continued to track composition of the catch. It was recommended that continuation of the seine boat mark recovery program be reevaluated, and that the accuracy of counts and interception of tags at the Pallant Creek fence be improved.

Contact: Lynda Orman, Biologist, North
Coast Division, FSB.

e) Cumshewa Inlet

The Cumshewa Inlet test fishing and stock separation program initiated in 1982 was continued from September 12 to October 23, 1984. The results of the 1982 study were used to modify the 1984 study.

Five to six one-hour gillnet sets were made daily. Four of the sets were standard sets at Renner Pt., the Holding Area and two at Conglomerate Point. The remaining sets were experimental, aimed at maximizing catch and quality. Biological characteristics (age, sex, length) were sampled from 30 chum salmon per day. Total catch by species, hatchery contribution and fish quality were noted for each catch. The 1984 test fishery provided an additional index of abundance, since escapements were in order of 100,000 compared to 10,000 reported in 1982.

On September 26 and 27, during the fishery opening in Cumshewa Inlet, the test fishing program was conducted in Selwyn Inlet. Seven locations were sampled with a high proportion of dark fish caught in sets in the inner inlet and quala and bright fish caught in sets on the outer section of the inlet.

Results from the test fishery studies are being used to develop a management technique for effective harvest of Pallant Creek hatchery chum salmon.

Contact: Lynda Orman, Biologist, North
Coast Division, FSB.

FRASER RIVER

a) Tahltan Lake Sockeye Smolt Enumeration

In an attempt to begin compiling baseline information on sockeye smolt production from Tahltan Lake, a juvenile sockeye enumeration program was undertaken in 1984 at the lake outlet. Smolts were live-captured, utilizing Wolf traps; enumerated by a volumetric displacement method and released. A subsample was anesthetized, examined for size (length and weight) and age and released after recovery.

A total of 219,597 smolts were enumerated during the period May 11 to July 11, 1984. Eighty-nine percent of this run was composed of sub-two aged smolts (one annulus) with the remainder being sub-three's (two annuli). Further analysis will relate potential brood year egg deposition to smolt survival. Unlike other northern systems where distinct nocturnal migratory behavior has been evident, no consistent diel pattern was identified at Tahltan Lake. In fact, the peak hourly count occurred between 1700-1800 hours. As expected, size increased over time ranging from a mean fork length and a mean weight of 82 mm and 4.8g, respectively during mid-May, to 110 mm mean fork length and 11.7g mean weight by mid-July.

Preliminary recommendations include advancing the start-up time to mid-April and conducting studies to examine predation of smolts by Dolly Varden and rainbow trout.

Contact: Robin Harrison, Senior
Management Biologist, Fraser
River/NBC/Yukon Division,
FSB.

b) Adult Chinook Recovery in Fraser River at Tete Jaune

The objective of this study was to recover CWTs from adult chinook salmon in the Fraser River at Tete Jaune and Swift Creek and to estimate chinook salmon populations in these two areas. The project was conducted from August 16 to September 25, 1984. The CWTs were recovered during dead pitch studies in the upper Fraser and Swift Creek. Biological samples (scales, length, sex and spawning success) were taken from unclipped carcasses. Heads of fish with clipped adipose fins were taken for CWT identification. Enumeration of spawning population was estimated using the Petersen mark recapture technique in the Fraser River and visual counts during numerous foot surveys on Swift Creek.

Four adipose-clipped fish were found in the upper Fraser at Tete Jaune and eight were recovered from Swift Creek. Among the Tete Jaune recoveries, three were 1978 brood year and one was from the 1979 brood. For Swift Creek recoveries, six were from the 1979 brood and one was from the Tete Jaune tagging of the 1979 brood.

In the mark recapture study at Tete Jaune, a total of 327 tags were applied to prespawners with 49 tagged fish recovered out of a total of 893 carcasses examined during the dead pitch. The population estimate using the Champman modification of the Peterson estimate was 5,865 chinooks with the upper and lower limits (@ 95 percent confidence) being 7,717 and 4,443 respectively. The population in Swift Creek was estimated at 1,200 chinook, based on frequent observations with a high count of 895 on one day. It was recommended that the Peterson mark recapture study be continued in the Fraser River, since other methods do not provide as reliable population estimates.

Contact: Ken Wilson, Chinook
Management Biologist, Fraser
River/NBC/Yukon Division,
FSB.

c) Fraser River Bar Creel Survey

A creel census was conducted on the lower Fraser River bar fishery in 1984. The primary objective of the 1984 study was to develop an analytical procedure and study design to be used in future years. The study results will determine catch, effort and hatchery contribution to the sports fish catch to be used in management of the Fraser River bar fishery. The 1984 results are being analyzed and final program design recommendations are being formulated. The report is forthcoming.

Contact: Neil Schubert, Management
Biologist, Fraser
River/NBC/Yukon Division,
FSB.

d) Birkenhead Coho CWT Recovery

A program to estimate the coho salmon spawning population and examine carcasses for missing adipose fins was conducted on the Birkenhead River. In 1984, 1,379 adult coho salmon were tagged with Petersen disc tags. A total of 1,030 carcasses were recovered, of which 118 were marked with Petersen tags. The population was estimated at 11,600 coho salmon. Of the returning population 7.7 percent were marked with CWTs. Survival and interception rates in the various fisheries can be determined once Canadian and American fisheries catch data are assessed.

Contact: Neil Schubert, Management
Biologist, Fraser
River/NBC/Yukon Division,
FSB.

e) Pitt River Coho CWT Report

A report summarizing all spawning ground recoveries of coho salmon in the Pitt River from 1982 to 1984 was prepared in 1984. These brood years are the returns from the 1979-1980 juvenile releases. A total of 168,000 juvenile coho salmon were tagged (CWT) in 1979 and 1980. The results of the studies will provide information on fishery contribution, timing, survival and marine distribution of Pitt River coho salmon. In the 1982-1984 adult studies, the number of marks in the escapement and relative contribution of each tag group was determined; location, distribution and timing of spawning was identified; annual escapements were estimated, and biological characteristics were sampled. Preparation of the report was contracted and a final report is expected to be published in spring 1985.

Contact: Neil Schubert, Management Biologist, Fraser River/NBC/Yukon Division, FSB.

REGIONAL

a) Coastwide In-season Data Management System for All Species

In 1984, a new standardized system was established for fishery data reporting on a coastwide basis. This involved preliminary data collection and presentation of catch, gear, location, openings and closures using the Visicalc computer format. Now that this format is established, the results can be published annually in data reports for each Statistical Area. Although data interpretation is minimal, a preliminary review of fisheries data and the management decision-making process will be available to DFO staff, industry and the public shortly after the fishing season.

Contact: Al Gould, Management Biologist, South Coast Division; Dave Peacock, Management Biologist, North Coast Division; Morley Farwell, Sr. Management Biologist, Fraser River/NBC/Yukon Division, FSB.

b) Key Work on Chinook Streams

In 1984, a chinook key stream program was initiated to obtain more comprehensive information from representative B.C. chinook systems. These systems were chosen on the following criteria:

- that there was a historic base of accurate enumeration
- that coded-wire tag groups were present
- that they were typical in terms of timing and life history of other systems in the area and
- that they had an opportunity to integrate with existing chinook programs.

The systems chosen were the Kalum, Atnarko, Bowron, Shuswap-Eagle, Harrison, Big Qualicum, Quinsam-Campbell, Somass-Robertson and Devereux. The program required obtaining accurate escapement estimates by sex, by age composition by sex, and by number of coded-wire tags by code number from natural spawners in adjacent rivers and from hatchery racks.

Funding for these programs was obtained from Field Services, SEP manageability and through job creation programs and they were conducted by both divisional and contract personnel in the Fraser River and South Coast divisions, and by contract only in the North Coast.

The programs were reasonably successful but there were unexpected problems endemic to each system and other problems caused by extreme environmental conditions. The estimates have been adjusted for these factors and are the best available for these systems.

Estimates using carcasses enumeration and rack counts were more accurate than would have been made by the normal visual estimates. Detailed information on marks, age composition and statistical analysis will be published in individual technical reports.

Through the use of information gained from these programs, the rebuilding of natural chinook stocks will be possible and the management of enhanced chinook will be more compatible with that of natural chinook.

Contact: Ken Pitre, Regional Chinook and Coho Biologist, Salmon Coordinators Unit, Salmon Services, FSB.

HABITAT

a) Stikine River Biophysical Study

Field studies in the Canadian section of the Stikine River system were conducted from June to mid-October 1984. The objectives of the study were:

- to determine locations and timing of spawning and rearing of Pacific salmon and, when possible, to estimate abundance
- to collect biological information and tissue samples from all sockeye salmon stocks in the Stikine system for stock identification analysis
- to conduct a biophysical habitat inventory of the Stikine/Iskut watershed and
- to document salmonid spawning and rearing areas which may be affected by proposed forest harvesting activities.

Major chinook spawning areas were found in Christina Creek and Craig River. Major sockeye spawning areas were found in Christine Lake, Chutine River, Scud River, Christina Lake and in the Iskut River mainstem. Chum and pink salmon spawners were observed in the Katete River and in the upper Iskut mainstem. Rearing surveys indicated that chinook juveniles were primarily in the mainstem and, to some extent, in river backwater habitats; sockeye juveniles were primarily in river backwaters and also in tributary backwaters and mainstem habitats and coho salmon juveniles were almost exclusively in tributaries and tributary backwater.

Sockeye stocks in the Stikine River exhibit great variation in biological traits used for stock identification. Samples of tissue (heart, liver, muscle and eye), for electrophoretic analysis, brain for parasite infestation analysis, scales, otoliths, and length/sex data were collected from 50 to 100 sockeye salmon spawners from Chutine Lake, Chutine River, Scud River, Christina Lake, Iskut River opposite Bronson Creek and Iskut River at Verrett Creek. In addition, approximately 800 sockeye salmon caught in the lower Stikine test fishery by the Alaska Dept. of Fish and Game were sampled for brain tissue, scales, length, sex and egg diameter. Identification of Stikine sockeye stocks is necessary to improve estimates of production, and determine interception rates in the fisheries.

Description of stream habitats in the study area were compiled, mapped and photographed using a modified version of the B.C. Ministry of Environment's Aquatic Studies Branch (ASB) method for aquatic inventory. Proposed areas of forest harvesting activities were examined in the field and potentially affected rearing and spawning habitats were identified and mapped. A detailed report summarizing the results of the study will be available March 1985.

This study was jointly funded by several groups within DFO including SEP, International, Habitat and Research. Additional funding was provided by Department of Environment.

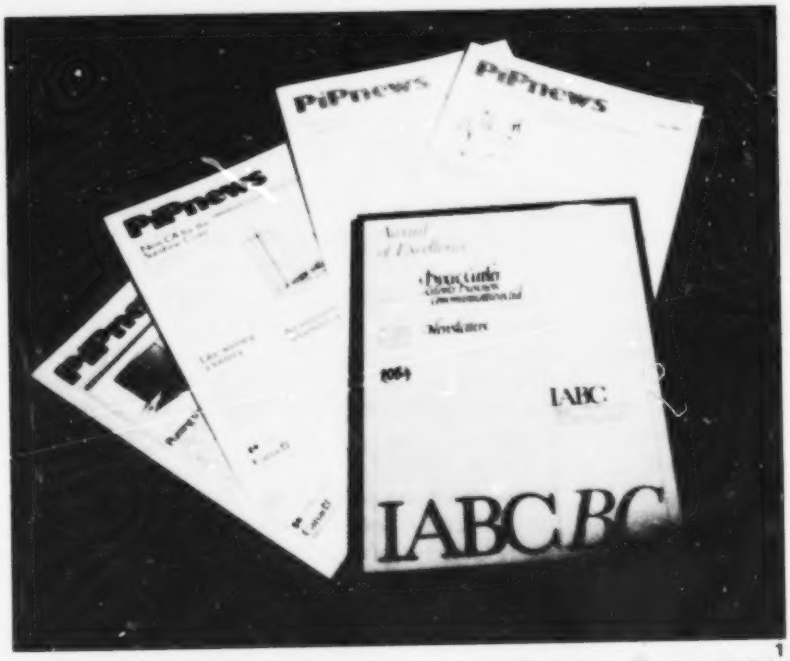
Contact: Peter Delaney, Habitat
Biologist, Habitat Management
Division, FSB.

b) Report on CWT Coho and Chinook Salmon Juveniles in the Cowichan Estuary 1973, 1975 and 1976

Juvenile outmigrant chinook and coho salmon were code-wire tagged in 1973, 1975 and 1976 in the Cowichan River and estuary. Subsequent purse seine sampling was conducted in the estuary. In 1984, the data analysis was finalized and a report was prepared. The report describes the distribution, abundance, timing, residence period, growth, stomach contents and scale patterns of juvenile chinook and coho salmon in the estuary. Analysis of adult returns may provide survival estimates for estuarine reared fish. The report will be published in 1985.

Contact: Bruce Hillaby, Habitat
Biologist, South Coast
Division, FSB.

1. PIPnews, published to serve volunteers, was given an Award of Excellence by the International Association of Business Communicators, B.C. Chapter.
2. Another IABC Award winner: the Our Resource campaign increased awareness with displays like this nose tag recovery demonstration.


PiPnews
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Award of Excellence
Newsletters
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Program Direction and Communications

Salmonid Enhancement Board

In August 1978, the Federal Minister of Fisheries and Oceans in consultation with the provincial government, established the Salmonid Enhancement Board to provide advice and recommendations concerning the management and direction of the Program.

The Board is the senior advisory group for the Program and its membership consists of 12 representatives from the federal and provincial governments and from the private sector. Private-sector appointees represent the interests of commercial and recreational fishing, Native people, the forest industry and the public at large.

Two regular meetings of the Board were held in 1984, one of which was a joint meeting with the Salmonid Enhancement Task Group.

In keeping with the assessment theme of the Transition Phase, the Board reviewed both internal and contracted evaluations of the Salmonid Enhancement Program. As well the Board continued to review and make recommendations on regular program activities and offered advice in planning related to the future of the program.

Contact: Pam Goh, Secretary to the
Salmonid Enhancement Board.

Salmonid Enhancement Task Group

The Salmonid Enhancement Task Group (SETG) is the primary public advisory group to SEP. It provides the views and advice of a broadly-based, non-governmental group on matters which are within the responsibility of SEP. The membership represents the resource user groups and the general public and reports to the Salmonid Enhancement Board.

SETG members include representatives of the commercial and sport fisheries, the processing industry, and other interacting groups such as mining, forestry, tourism, B.C. Hydro, municipal governments, education, consumers, conservationists, media and taxpayers. (See Appendix D for list of current members.)

The SETG had three full-group meetings during 1984. In March, the Task Group met with the Salmonid Enhancement Board and DFO's director-general of Pacific Region to give input on issues and options for developing a new Pacific fisheries policy. Consensus was that SEP should be a strong component of an overall fisheries policy.

In June, the Task Group reviewed the status of the Transition Phase and the planning for SEP continuation. Members also studied the fish/forestry interaction research program on the Queen Charlotte Islands.

A field trip to Chilliwack River hatchery and the Semiahmoo Fish and Game Club's volunteer project on the Little Campbell River highlighted the Task Group's October meeting. The Task Group also examined predator research, Pacific fisheries development program opportunities and project ideas, and received an update on the education component of SEP.

Contact: Doug Aberley, Chairman,
Salmonid Enhancement Task
Group.

SEP Information Program

The original plan for SEP included as an objective; "to increase the community awareness of the problem of salmonid's survival, to inspire awareness of solutions to these problems, and to strengthen the role of the public in helping to conserve the salmonid resource and its habitats." An ongoing series of programs and activities has been directed at meeting this objective since the first days of SEP.

In 1984, in response to Pearse Report recommendations, the last issue of "Salmonid" magazine was published; future communications from SEP to the audiences addressed by "Salmonid" will be integrated into other DFO publications.

New forms of communication were undertaken in 1984, however, with the initiation of "PIPnews" and with strong SEP involvement in the DFO Public Awareness Campaign.

"PIPnews", with its enclosed "Tipsheets", is published four times per year to bring information and technical advice to Public Involvement Program volunteers. Response to the first two issues, sent out in 1984, was very positive, and the clarity with which this newsletter meets its stated objectives led to its being given the "Award of Excellence" for newsletters by the B.C. chapter of the Internation Association of Business Communicators for 1984.

The Public Awareness Campaign was also an IABC "Award of Excellence" winner in the communication program category. This campaign, which ran through the summer and fall, involved nine communities in B.C. Participants included hatcheries, fishery officers, patrol vessels and a number of native and public enhancement projects. The campaign objectives were to increase public understanding of the value of DFO's activities, of the need for enhancement, and of the ways in which the public and DFO can cooperate to maintain and enhance the resource.

As well as these new activities, SEP continued its existing communication efforts to a variety of audiences through informational signs, use of the SEP display, publication of brochures and of this large report and its companion, the summary report.

Contact: James Boland, Head, Public
Involvement Unit.

Educator's Package

The SEP educational coordinator has several responsibilities:

- researching, drafting and editing material for SEP's curriculum package Salmonid In The Classroom.
- promoting its use by conducting in-service sessions for users of the curriculum materials
- providing input into the development of SEP information/education support materials for Salmonids In The Classroom.
- maintaining liaison between DFO staff and the educational community.

In 1984, production of the primary component (Kindergarten to Grade 3) of Salmonids In The Classroom was completed. During the fall, the educational coordinator conducted several workshops in various school districts to properly introduce the package and promote its use. The response by teachers and school administrators at these workshops was very positive.

Additional workshops were held for DFO fishery officers to improve their presentation skills for the classroom and to introduce their own version of Salmonids In The Classroom.

The coordinator continued to work with selected hatcheries (i.e. Quinsam, Qualicum and Robertson Creek) to assist their education outreach activities with their respective communities. The activities included the development of educational material pertinent to each facility for school tours as well as inclass activities in preparation for hatchery tours.

Further efforts were directed to the development of support materials for the curricular packages such as eggs-to-fry specimen displays, posters, games and three short videotapes.

Contact: Linda Bermbach, Education
Coordinator; James Boland,
Head, Public Involvement
Unit.

Appendices

A. SEP Fish Production, Forecast Catch and Production Capacity

Summary of 1984 SEP Fish Production*

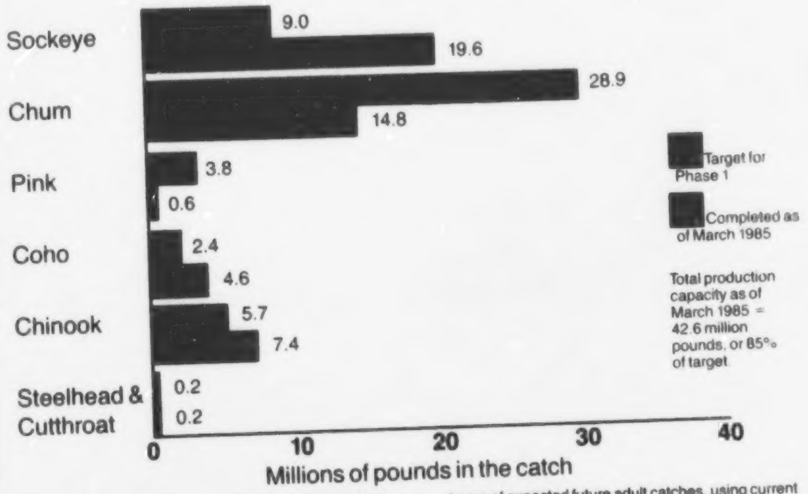
Species	Juveniles Released	Expected Adult Production
Sockeye	149,118,056	2,550,720
Chum	144,352,780	2,329,620
Pink	8,779,898	219,498
Coho	15,546,283	1,128,342
Chinook	28,045,547	824,957
Steelhead	2,472,902	42,450
Cutthroat	182,607	8,441
TOTAL	348,498,073	7,104,028

*Includes production from all SEP facilities and projects, and lake enrichment.

Forecast Catch from Existing SEP Projects* at Design Capacity**

	Canadian Catch	
Species	Pieces	Pounds
Sockeye	1,317,458	7,540,742
Chum	1,279,119	14,831,565
Pink	133,619	573,273
Coho	910,428	4,580,243
Chinook	838,892	7,417,625
Steelhead	25,939	266,965
Cutthroat	12,894	6,447
TOTAL	4,518,349	35,216,860

Figure 1: SEP Production Capacity by Species: Phase 1 Targets and Performance to Date*



Total production capacity as of March 1985 = 42.6 million pounds, or 85% of target

*Production capacity measures the capacity of facilities which have been constructed since 1977 (SEP facilities only) and are now operational. The capacity is stated in terms of expected future adult catches, using current facility capacities, current expected egg to adult survival rates of enhancement techniques, and projected future Canadian catch rates. Source: Regional Planning

B. Financial Statements

SEP Expenditures by Program Area
(In Thousands of Dollars)

Program Area	**1977/78**	**1978/79**	**1979/80**	**1980/81**	**1981/82**	**1982/83**	**1983/84**	**1984/85**
Major Production Projects	$1,621	$ 6,754	$11,974	$12,847	$12,897	$ 9,715	$ 3,455	**$ 3,691**
Minor Production Projects	252	726	1,098	1,461	1,212	1,211	1,188	**1,921**
Pilot Production Projects	283	284	135	244	181	383	211	**1,232**
Facility Operations/Maintenance	1,344	2,803	3,820	5,777	8,150	9,345	11,711	**15,928**
Community Development Projects	453	1,929	2,813	3,168	2,959	3,672	3,746	**4,715**
Lake Enrichment	307	676	1,095	1,345	1,454	1,801	1,874	**2,157**
Public Involvement	505	829	830	874	1,051	1,278	1,234	**1,480**
Reconnaissance/Feasibility Studies	1,581	754	1,508	1,588	990	394	305	**1,336**
Manageability/Environmental Studies	764	1,725	1,267	1,488	730	567	560	**842**
Evaluation/Assessment Studies	354	608	157	402	332	294	320	**1,388**
Research Studies	459	461	644	691	396	718	544	**774**
Program Planning and Direction	791	1,032	1,196	1,633	775	1,361	813	**762**
Provincial Program (Federal Share)	364	865	688	744	376	460	417	**698**
Provincial Program (Provincial Share)	264	289	1,243	1,250	1,250	1,250	1,250	**1,500**
TOTAL	$9,342	$19,735	$28,468	$33,512	$32,753	$32,449	$27,628	**$38,424**
Source of Funds								
SEP Phase 1	$7,878	$17,146	$24,735	$28,462	$26,911	$26,000	$18,800	**$17,700****
DFO* Contribution	1,200	2,300	2,500	3,800	4,592	5,199	7,578	**19,244**
Provincial Share	264	289	1,243	1,250	1,250	1,250	1,250	**1,500**
TOTAL	$9,342	$19,375	$28,478	$33,512	$32,753	$32,449	$27,628	**$38,424**
Phase 11 Program Development	—	—	—	—	$ 2,466	$ 1,496	$ 1,484	

*Dept. of Fisheries and Oceans

**Phase 1 ended in 1983/84. Transition Phase started in 1984/85

Enhancement Operations and Maintenance

Project	**Amount**
Enhancement Ops. Admin.	$ 1,891,800
Quesnel	1,013,300
Eagle (S. Thompson)	503,400
Inch Creek	643,800
Chehalis River	578,100
Chilliwack River	707,200
Cheakamus - Tenderfoot	351,000
Jones Creek	4,600
Capilano	598,900
Birkenhead	123,000
Big Qualicum River	952,600
Little Qualicum River	288,000
Puntledge	776,600
Chemainus Chinooks	118,200
Tlupana Inlet	1,079,200
Nitinat	757,000
Robertson Creek	885,200
Quinsam River	967,500
Snootli Creek	648,600
Kitimat River	931,200
Fulton River	455,200
Pinkut Creek	366,600
Pallant Creek	559,100
Mathers Creek	135,200
Kakweiken	16,900
Expo 86	534,700
General	41,100
Total	**$15,928,000**

Public Involvement

Project	**Amount**
Secretariat	$ 29,100
P.I. Administration	550,400
Information	175,700
Annual Report	46,900
Education	90,500
Participation Support	119,200
Advisory Group	10,600
Kamloops Community Advisor (CA)	49,700
New Westminster CA 1	67,300
New Westminster CA 2	43,300
Sechelt CA	35,500
Nanaimo CA	57,700
Victoria CA	43,500
Port Hardy CA	63,700
Terrace CA	56,700
Queen Charlotte CA	41,100
Total	**$ 1,480,900**

Minor Production Projects

Project	**Amount**
Administration	$ 1,281,900
Stream Catalogue	39,600
General Support - Biology	65,700
Assessment	8,300
Chilliwack	3,000
Stream Clearance	14,300
Fishway Repair	2,900
Hatchery Manuals	43,000
Mamquam Channel	9,400
Chilqua Slough	16,700
West Creek	200
Judd Slough	32,000
Alouette River	43,700
Vancouver River	23,500
Yukon Transplant	11,300
Tuya River	12,000
Owikeeno	5,300
Chehalis	400
Seabird Side Channel	1,600
Barriere	11,100
Nanaimo	1,900
Cowichan	3,100
Sliammon	5,400
Powell River	2,000
Sechelt	9,100
Thornton Creek	100
Kyuquot	900
Ahousat	4,400
Port Renfrew	500
Port Hardy	1,500
Quatse River	50,100
Nimpkish	700
Bella Bella	13,200
Hartley Bay	4,600
Klemtu	1,600
Kincolith	7,800
Fort Babine	5,900
Terrace	10,000
Smithers Pilot	82,300
Kitsumkalum	31,000
Kispiox	6,700
Masset	8,700
Skidegate	1,600
Seaskinnish Fish Passage	2,600
Mainland Inlets	39,400
Total	**$ 1,921,000**

Major Production Projects Design and Construction

Project	Amount
Engineering Management	$ 908,800
Tenderfoot	112,400
Quinsam	266,200
Phillips	776,500
Kitimat	136,500
Clearwater	324,800
Nicola Flow Control	3,500
Spius	97,500
Eagle	992,300
Shuswap	72,300
Total	**$ 3,690,800**

Pilot Studies

Project	Amount
General Management	$ 90,000
Kokish	200
Iona Estuary	4,700
Squamish Estuary	13,600
Queen C.I. Forest Demo.	2,000
Clearwater	290,600
Spius	145,100
Shuswap	106,800
Devereux	579,000
Total	**$ 1,232,000**

Reconnaissance/Feasibility

Project	Amount
Administration	$ 339,000
Water Quality	65,300
General Studies	99,000
Nicola	34,500
Shuswap	45,300
Knight	103,800
Bentinck	87,900
Smith	60,700
Gardner	89,100
Skeena	90,500
WCVI Recon. & Feas.	25,400
Mainland Inlets	76,000
Central Coast	8,800
North & Yukon	18,500
Fraser	77,800
Chilliwack Water Supply	103,500
Queen Char. I.	11,000
Total	**$ 1,336,100**

Program Planning and Direction

Project	Amount
Executive Director	$ 274,000
SEP Board	17,500
Claims Ag. Crown	4,600
SEP Administration	255,500
Finance Support	210,000
Total	**$ 761,600**

Evaluation and Assessment

Project	Amount
Administration	$ 427,000
Bio. Econ. Analysis	55,300
Man. Studies	30,100
Quota V. Fixed	1,600
Clipped Fish	9,100
Strat. Overview	54,400
Recreational Fishery	62,000
Salmon Mktg.	75,600
World Sal. Prod. Outl.	16,700
UBC Com. Model Cont.	113,200
DPA Simulation	35,700
Native Fish Data	3,800
Th. Riddell Surv.	53,000
Reg. Plan. Model	57,600
Area Plan. Model	8,600
Cabinet Doc.	8,000
SEP Eval. Mod. Update	195,900
Proc. Sec. Coast Analysis	2,700
Stock Interaction	29,000
Cdn. Pacific Salmon Stock	38,200
Stock Rebuilding	65,000
Record Mgmt. Dec.	45,700
Total	**$ 1,388,200**

Manageability and Environmental Impact Studies

Project	Amount
Chinook Escapement Studies	$ 101,700
Fraser R. Management	57,100
South Coast Management	120,200
North Coast Management	81,500
Mark Recovery	482,000
Total	**$ 842,500**

Provincial Programs

Project	**Amount**
Deadman Rehabilitation	$ 55,700
Deadman Fence	31,400
Steelhead Inventory	43,600
Federal Tagging	35,300
Tag Purchase	106,500
Creel Census	173,400
Hanceville	23,400
Stream Fertilization	96,200
Cutthroat	33,700
V.I. Report Writer	41,400
Other	42,600
Skeena Racial Studies	14,600
Total	**$ 697,800**

Research

Project	**Amount**
Program Support	$ 61,700
Assessment	6,000
Hatchery I & R	79,800
Time and Size Release	178,300
Salmon Genetics	106,800
Control Reproduction	121,700
Nutrition	77,700
Disease Control	29,600
Diagnostic Services	112,300
Total	**$ 773,900**

Lake Fertilization

Project	**Amount**
Program Management	$ 69,600
Juvenile Ecology	84,300
Adult Ecology	33,600
Data	7,800
Survey and Research	31,200
Phytozoa Dynamics	36,400
Chilco Lake	15,000
Treatment	1,009,800
Monitoring	869,300
Total	**$ 2,157,000**

Community Economic Development

Project	**Amount**
CEDP Administration includes Mand. Training	$ 512,700
Water Sampling	600
Tagging	43,200
Project Advisors	604,300
Klemtu	80,800
Hartley Bay	56,000
Skidegate	49,000
Kitsumkalum	64,600
Oweekeno	49,700
Fort Babine	76,700
Nuu-Chah-Nulth #1	21,800
Nuu-Chah-Nulth #2	37,700
Necoslie	93,800
Chehalis	110,800
B.C.I.T.	192,200
Central Int. Tribal Council	145,700
North Thompson	71,800
Penny	24,500
Seabird Island	15,700
Deadman Indian Band	20,100
Nanaimo	233,700
Cowichan	211,800
Sliammon	183,600
Sechelt	166,700
Powell River	149,600
Thornton Creek	122,400
Port Renfrew	81,400
Northern Van. Is. Assoc.	165,400
Nimpkish	254,100
Terrace Kitsumkalum	149,000
Heiltsuk	175,300
Kincolith	138,900
Kispiox	210,400
Masset	200,900
Total	**$ 4,714,900**

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Glossary

alleles: two or more contrasting genes present at the same locus which determine alternative characters of inheritance.

clones: all the descendants derived assexually from a single individual, they are identical in characters with one another; purebred.

cryopreservation: storage of gametes (sperm and eggs) or embryos by freezing at very low temperatures.

"female milt": gametes (sperm) produced by a (sex inverted) male of female genotype.

genotype: the fundamental hereditary constitution (assortment of genes) of an individual.

gynogenesis: a special form of parthenogenesis in which the egg is induced to develop without the contribution of chromosomes from the sperm.

homogamety: condition of having but one class of gametes with respect to the sex chromosome, as in the human female and female salmonid fishes.

homozygosity: possessing an identical pair of alleles in regard to a given locus or to all loci.

LHRH: a brain hormone which controls gonadotropin production and release.

LHRH$_a$: luteinizing hormone releasing hormone analogue: synthetic high potency analogue of mamalian LHRH effective for the induction of final maturation in teleosts.

parthenogenesis: the development of an egg without fertilization.

polyploidy: condition of having more than two full sets of homologous chromosomes (triploidy: three sets; tetraploidy: four sets).

radioimmunoassay: measurements of extremely low levels of biological substances, by displacement of labelled material bound to a specic antibody.

spermiation: final maturation of sperm in the testes prior to spawning, characterized by an increase in water content.

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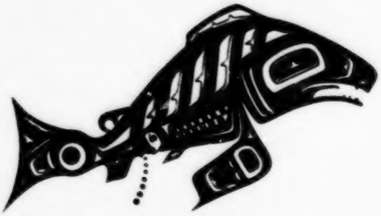

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